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TRANSACTIONS

OF THE

EPIDEMIOLOGICAL SOCIETY

OF

LONDON.

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SESSION 1884-85.

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C. 1855. Virchow, Rudolf, Professor, 10, Schellings Strasse, Berlin.
C. 1856. Von Iffland, —, Beaufort, New Quebec.
N.R. 1879. Watson, Alexander, M.D., R.N., Dep. Insp.-Gen., Army and Navy Club.
C. 1853. Watson, John, M.D., Jamaica.
N.R. 1880. Whishaw, J. C., M.D., Surg.-Major Ind. Med. Dept., Lucknow.
N.R. 1880. White, J. Berry, M.D., Surg.-Major Ind. Med. Dept., St. Andrew's House, Hertford, Herts (*retired*).
C. 1861. Whitelaw, Wm., M.D., Kirkintilloch, Dumbartonshire.
N.R. 1854. Wiblin, John, Southampton.
N.R. 1865. Williams, C., 9, Prince of Wales's Road, Norwich.
N.R. 1872. Woodall, John (address not known).
N.R. 1875. Wortabet, John, M.D., St. John's Hospital, Beyrout.

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ON SOME RARE EPIDEMICS AND ENDEMICS.

By NORMAN CHEVERS, C.I.E., M.D., President.

Inaugural Address of Session 1884–85.

(*November 12th*, 1884.)

Gentlemen,—Since we last assembled in this place, death has taken from our Association one who, although younger than most of us, was second to none as a man of science. The daily business of the life of John Netten Radcliffe was epidemiology, and when that life closed prematurely a few weeks ago, there was not in Christendom any investigator of disease to whom the title of "epidemiologist" was more justly due than it was to our late esteemed and lamented fellow-workman, an inquirer as honest as he was able, upon whose brief and by no means painless mundane existence the divine light of truth was bountifully shed.

Considering how few and brief our meetings are, I, at the opening of last session, submitted to you for discussion an epidemiological subject, as being more in accordance with the great objects of our Society than an ordinary "presidential address", dealing with unpractical generalities. I shall again adopt this course.

I, however, have nothing to communicate didactically. As a seeker for knowledge, I lay before you a few somewhat obscure points in epidemiology, which, I doubt not, it is within your power to elucidate.

I happened lately to meet with a citation of the following passage from the *Chronicon Angliæ Petriburgense*, recording that, in the year 987, "duæ pestes mortiferæ, Anglis antea ignotæ, Angliam invadunt; febris quædam et morbus, quem scitam* dicunt."

Without pausing to inquire how far the leech-craft lore

* The name of this disease survives in the English vernacular. A looseness which is very prevalent among cattle in Natal is called "Skitters".

of that early age was competent to decide whether the type of an epidemic was or was not absolutely new or old (seeing that we of the present day occasionally puzzle greatly over such questions), I, having lived at a time when the enteric fever of Jenner was not common in England, and when diphtheria was of rare occurrence in this country, India, and Australia, venture to think that you may not be unwilling to devote a little attention this evening to the consideration of certain epidemic and endemic diseases which are either positively of rare occurrence, or are, as appears more probable, so irregularly distributed over the earth's surface, and so uncertainly fluctuating in their occupation and transgression of their proper areas, and so changeful in their types as to appear new to the ordinary observer, and often to lead men of travel and reading to hesitate in declaring that they are old.

We may be led to call any given outbreak of disease which appears unusual to us "rare", (1) because we are imperfectly acquainted with the geographical distribution of disease. Thus, in a given case, upon our remark, "this type of disease is perfectly new to me", an American or Indian practitioner may say, "this is pernicious fever, with which I am well acquainted." (2) Few observers live long enough to see disease in all its constantly varying types. If London practitioners could now see the type of maculated typhus, with lung complication, which prevailed in this city in one of my years of studentship, they would doubtless call it "rare". Truly, it was a rare type of that which was then one of the commonest diseases of these islands, but which is now far less prevalent. (3) Or, again, it is within the range of possibility that there should occur any day in our midst an outbreak of disease, regarding the type of which many practical men might be quite at fault, until they were told by one who had lately read Hecker, "this is a reappearance of the Black Death, which killed fifty thousand persons in London in the year 1347."

I think that I do not claim too much for the Epidemiological Society when I say that, constituted as it is of men who have studied disease in all its modern phases in every quarter of the globe, and who, in the library and in intercourse with their professional brethren, have made it the subject of life-long inquiry, it is at these serious but most friendly and pleasant conferences that the very fullest light may probably be thrown upon whatever still appears to be novel or rare in the characters of epidemic and endemic disease.

Bear with me while I lay before you, in the form of questions, the following subjects for discussion.

In his recently published invaluable work, *An Epitome of Reports of Medical Officers of the Chinese Customs Service*,* our friend Dr. Gordon cites the following report:—

"At Newchwang, during the winter of 1880-81, quinsy attacked nearly every foreign adult in the settlement. The majority of the patients had more than one attack; in some instances the disease was very severe. The largest number of cases and the most severe occurred in the first half of the winter. After a considerable fall of snow, the cases decreased in number and severity."

It is a common matter of observation that simple tonsilitis occurs epidemically, particularly in cold and damp weather, but epidemic quinsy is, I think, rare, and I seek reference to similar outbreaks.

Seventeen years ago, a healthy girl of four was brought from India to Cheltenham. Shortly after her arrival, it was observed that she was jaundiced. This did not cause surprise, as the season was very chill, and she had suffered much from heat and fatigue on the homeward route. It was then noticed that her brother, an equally healthy child, three years her senior, who had been more than two years at home, was also jaundiced. The attacks were unattended with evidences of constitutional distress, and were very transient. I have heard of similar outbreaks of simple jaundice among the children of a neighbourhood, but would be glad to obtain further data.

I have a tolerably fair acquaintance with the history of the epidemics and endemics which have occurred in the neighbourhood of Calcutta during the last half century, but I have only heard of one extensive outbreak of inflammation of the external meatus of the ear. This occurred in the rainy season of 1857. Thousands suffered, mostly along the north bank of the Hooghly, from otorrhœa, the mischief not unfrequently involving the structures of the tympanum. Have similar endemics been observed?

In Calcutta, boils occur much more generally in some seasons than in others; but we usually see cases after the hottest weather. The types of furunculi do not appear to vary greatly, but only in one of my twenty-four hot seasons was there an outbreak, very prevalent among children, of livid vesicular boils about as large as peas, which burst spontaneously, and discharged an abundant damson-coloured cruor, so that the child had almost always a bloody streak

* P. 179.

down its face. Assuredly furunculus is as essentially a constitutional disease as septicæmia is; but our knowledge of its ætiology greatly needs extension.

At Howrah there was an endemic of mumps among the children inhabiting a row of houses fronting a partially tidal earthen ditch, into which the excreta of the large gaol were voided. Two little European brothers were attacked with exudative laryngitis (diphtheria?). I am aware that cases of mumps, complicated with diphtheria, have been observed, but I am still in search for detailed histories.

About twelve years ago, while residing in Calcutta, and subject to malarious asthma, I suffered occasionally from another neurosis—a moderate colicky pain in the sigmoid flexure, lasting for an hour or two. On the morning of the day preceding my departure for England, I visited my college, breakfasted comfortably at a friend's house, and ordering my carriage for a round of calls, was told that my coachman (a Mahomedan whose mode of life was as different as possible from my own) was ill. I went to the man in anger, but at once perceived that he was in great agony with colic. I said that I would give him medicine, but before I had gone up a flight of stairs I was attacked with most excruciating colic, from which I suffered for hours. I remained subject to occasional recurrences of this neurosis for about two years, but this was by far the most severe attack. I do not think that I saw a dozen cases of colic in India.

I am confident that this was no mere coincidence. I had merely looked at the man, had asked a question or two, and had turned to leave him, when the pain struck me as if I had been shot through. Had this happened to a hysterical woman, I could have better understood it; but that the nervous system of a medical man, in charge of a large hospital, should be thus sympathetic is a matter which I have hitherto entirely failed to comprehend.

In January 1883, the inmates of my house in Bayswater were ten in number. On the first of that month I noticed a large herpetic spot on the lip of one of them. This recurred on the 27th. I was then told that a servant girl had been suddenly attacked with painful swelling of absorbent glands at the back of the neck. I found that this was caused by a large blotch of herpes just below the hair, and immediately above the upper enlarged gland. On the twentieth of that month, Dr. G. H. Savage published in the *Lancet* a report on "Herpatic Fever", as it prevailed in London. I think that this point deserves further investigation.

Some of the conditions to which I have now alluded were

undoubtedly *endemics*, rare, as far as my experience and reading go, which is admittedly not very far. In the classification of the others I solicit your assistance.

With regard to manifestations of disease on a more extensive scale, some *epidemic* outbreaks may only appear to us to be rare because we are imperfectly acquainted with the epidemic history of the sites in which they occur. Thus, it has not been proved that diphtheria appeared in India earlier than 1852, or in Australia before *cir.* 1853; or that yellow fever had been seen in Monte Video previous to 1857; still it is quite within the range of possibility that we may yet discover musty records of the fact that these were not the first appearances of the diseases in those localities. Thus, about five years ago, we were told by a competent authority that South Africa enjoyed immunity from true enteric fever. A few months later, we learnt that our troops in the Natal field force suffered considerably from this disease; and our friend Inspector-General Lawson has lately informed me that he has found evidence of the presence of this fever at the Cape in 1827.

The evidence that certain epidemic diseases are rare in particular localities is unquestionable. So it is with cholera of the Asiatic type in these islands.

The last appearances of bubonic plague in England and in Southern France were respectively in 1665 and in 1720.

There is at present no evidence whatever to show that Beriberi fever had ever extended to Southern Bengal previously to the year 1877. Pali plague has never been observed in the plains of India since its first recorded outbreak in the Bombay Presidency in 1815; but its congener, Mahamari, has appeared at rare intervals in the hills; and its closely allied pest, Indian relapsing fever, has, happily unfrequently, committed terrible ravages in the North-Western plains.

In a recently published chapter of my work on the *Diseases of India*, I showed that a wave of influenza extended from India to England between the years 1824 and 1837. I then cited* accounts of the influenza which occurred in 1831 in Penang and Java, and in 1834 in Calcutta.

I have since learnt† that this disease also prevailed on the Continent of Europe and in England in 1831 and 1833. As we have no evidence of the recurrence of grave influenza since 1834 in Calcutta and 1837 in England, we may, while admitting that epidemic catarrh, which is so common nearly

* *Medical Times and Gazette*, vol. i, for 1884, p. 761.
† Hecker and Gordon.

everywhere, is a mild type of influenza, resolve to place grave influenza among rare epidemic diseases.

There is a disease, regarding the alleged epidemicity of which I am desirous to obtain your opinions. Scorbutus is stated by Hecker to have prevailed as an epidemic, more especially in Germany, in the year 1486, and with such severe and unusual symptoms, that people were inclined to regard it as a totally new malady. He cites various authorities in evidence that, on several occasions in the fifteenth and sixteenth centuries, scurvy occurred as an epidemic in Europe. All Indian authorities concur in the observation that scorbutus is constantly endemic in certain districts, especially in Scinde and Behar. Such endemicity may be accounted for upon the supposition that, in such localities, the soil and water are faulty, and that the food supply is defective in anti-scorbutic constituents; but various authorities, headed by Kenneth Mackinnon, have adduced facts which go far to show that, in India at least, scorbutus occasionally presents itself as an epidemic in localities out of the domain of endemic scurvy, quite independently of any abnormality of climate or food supply.

Additional observations upon this point will be exceedingly valuable.

In my addresses, delivered at our opening meetings in 1882 and last year, I made some allusion to the occurrence of dysentery in London. I then showed that the last prevalence of dysentery here occurred between the years 1840 and 1847. The details have been recorded by Dr. Baly, and that this malady was true dysentery I had convincing evidence in my own person. The almost complete subsequent immunity of London from this disease is proved by the fact that two distinguished hospital physicians, of middle age, have lately said to me, nearly in the same words, "I have never seen a case of dysentery originating in London." Nevertheless, the Registrar-General's returns, as cited in the public prints, give us to understand that—I quote one verbatim—"119 (deaths occurred during the week ending 18th August 1883, in London) from *diarrhœa and dysentery.*" In one week in the previous month of July, the newspaper gives 351 deaths from dysentery. Making due allowance for inaccurate citation by non-professional reporters, this assertion of the occurrence of a multitude of deaths from dysentery in a city whose physicians have never seen English dysentery, appears, to say the least, rather perplexing.

Undoubtedly the Registrar-General is as wrong in massing together cases of those perfectly distinct maladies, dysentery

and diarrhœa, as an ornithologist would be if he classed the owl with the sparrow. I lately spoke upon this matter to a very high non-professional authority. He said that the anomaly probably arose from a prevalence of cases of "dysenteric diarrhœa"—a disease of which I now hear for the first time, and in the existence of which, either at present or at any other time, I confidently disbelieve, diarrhœa and dysentery being two perfectly distinct entities, always to be differentiated by observing the symptoms and watching the stools. Hence I venture to offer, for an expression of your opinions and for your future investigation, the questions—Has dysentery occurred in London of late years? Does it continue to occur? And what is the true nature of the destructive malady which is spoken of as "dysenteric diarrhœa"?

Not many minutes after writing the above, I met with the following expressions, used by a sound pathologist in describing a case of tropical liver abscess observed in London. We are told that the man "had been suffering for some time from *diarrhœa*" (the italics are mine), "with slimy motions" . . . . "There was a return of the *dysenteric* symptoms"; the "motions were loose, slimy, and contained blood". Extensive dysenteric disease of the colon was found after death. The erroneous belief in the existence of such a disease as dysenteric diarrhœa probably arises from the fact that grave dysentery is not always attended with severe pain. Hence, doubtless, the fact mentioned in Rymer's *Fœdera*, that the English soldiers fought at Agincourt "naked from the waist downwards, because of the distemper" (dysentery) "which hung upon them". Had the poor fellows suffered as much as I always did in dysentery, they could not have fought at all.

I believe that a careful search for indigenous dysentery in London and its suburbs will probably lead to the discovery of genuine cases.

A year or two ago, my friend Dr. John Macpherson told me that a typical case had occurred at Forest Hill.

Having now offered you, out of an overflowing budget of ignorance, more questions than can well be answered in the few minutes which remain to us, I will merely say that I am heartily rejoiced at being allowed the great privilege of greeting you here again; and that I am confident in the hope that, in the future as in the past, our quest for scientific truth will continue to be ruled by brotherly friendship and large-minded toleration.

ON OLD LONDON: ITS INSANITARY CONDITIONS AND ITS EPIDEMIC DISEASES.

By Sir WILLIAM R. E. SMART, K.C.B., M.D.,
Hon. Physician to the Queen.

(*Read: Dec. 10th*, 1884.)

London was founded on a salubrious site, not in the Roman age, but in that of the Ancient Britons; not as a fortress, but as a convenient commercial emporium on a tidal river, up which Continental merchants could bring their wares secure from the pirates of the sea. From that primitive condition it has grown to be the centre of the mercantile world, and the metropolis of one of the grandest and the most extensive empire the world has ever possessed, with about four millions of inhabitants. Unlike modern seats of commerce founded by merchants on newly discovered shores, that have grown rapidly like young giants from their infancy, London was slow in developing itself; but, through the advantages of its position, it has outlived the fall of Roman, Saxon, and Norman masters, and has taken eighteen centuries of growth to attain its actual condition.

Primitively its site was a gravelly knoll on the banks of the Thames, rising to a moderate height, possessing many good springs of pure water on its hill-sides, with a considerable rivulet—the Flete—on its western boundary; a brook that flowed out of marshes in Finsbury—the Walbrook, which divided the site in halves; and two bournes—the Sherborne and Langbourne—that subdivided the eastward half of the City site. Although its own soil was of gravel and fine sands, on clay, yet around there were basins scooped or sunk here and there, as at Lambeth, at Westminster, and at Stepney, when the river was swollen, and on the flats of Finsbury after heavy rains; and hence there arose marsh miasmata, productive of agues from the earliest times; but now that these parts are sewered and drained, there are none of those morbific causes effective. A wall was built round it by the Romans, but that could scarcely have protected its inhabitants from these causes of disease, before drainage was completed; while, on the other hand, in later ages, when the

undrained city began to produce its urban malaria, remittent deadly fevers began to abound, and contagious or infectious typhus reared its many hydra-like heads, to remove or to subdue which London had neither hero, saint, nor king.

Sydenham, writing later than the Restoration, states of fevers, apparently from local reminiscences as a Londoner, "Many die by violent deaths; but, with the exception of these, two-thirds of our race die of fever." And when he wrote this London was more free from fever than it had been for several centuries.

These conditions were founded on general febrile diatheses, which were then termed "epidemic constitutions", from the type and the concomitancy of the fevers that were generated by a poisoned atmosphere and impure water-supply. In the reign of Henry III, the Flete and the Walbrook and the bournes had become virtually sewers, for the most part open; and the drinking waters were drawn from City wells, some of which lay within or were adjacent to churchyards, reeking with the effluents from the human remains that had been piled for centuries in the shallow graves,—these causes chiefly, in combination with the personally filthy habits and customs of a monastic long period, proved sufficient to render it, like all other European cities, the home and nest of malignant fevers of every description—the lasting, prompt, and fitting receptacles for the great Eastern bubonic plague that was endemic in Europe through centuries; from which, however, London was the first to be purged, and that accidentally, by the action of fire. Plague was normally an intense synochus involving the absorbent system, that gave immunity from future attacks, and was in no wise produced by poverty and bad feeding, for some of its worst outbreaks occurred in seasons of plenty; whilst the other destructive types of fever were either miasmatous, from the marshy surroundings, or typhous, of many varieties, sometimes complicated with plague or with the miasmatous types, or frequently arising in times of great scarcity of food amounting to famines, or approaching to them, and leaving sequelæ which are unknown in plague. So long as the bubonic plague retained its explosive force productive of epidemics, the proper exanthematous fevers would seem to have been held in abeyance; but when plague had disappeared they soon began to increase in frequency as well as in virulence, swelling the mortality returns, and showing, up to the end of the last century, a steady increase of deaths by them, in proportion to the total mortality.

The early history of our country is to be gathered from a

rich series of chronicles, written in the repose of the monasteries, which are, however, more diffuse on the affairs of its kings, princes, and ecclesiastics, than on those relating to the nation at large and its sufferings.

With regard to the City of London itself, there is a grand store, safely kept, as its special archives, from which are derived two very interesting authorised publications—the *Liber Albus*, of date 1451, compiled by John Carpenter, City Clerk; and *Remembrancia*, or Précis of the City Remembrancer's Office, with continuation to the Rebellion.

From these early sources much may be gained concerning the epidemics of London within their several eras, although vaguely reported; the science of medicine being then in its infancy, and not having arrived at a nomenclature of diseases.

When King James ascended the throne, in 1603, a very severe visitation of the plague was hatching, which led to the permanent institution of a Bill of Mortality, to be published weekly for the entire City of London and its Liberties, by the Company of the Parish Clerks, which was thus the actual forerunner of our Registrar-General's report, in making way for it, and by laying its foundation.

The epidemic diseases of London prior to the Great Fire (which cleared the ground for a new city to rise on the ruins) were typhus, maculated and petechial; synochus, plague, sweating sickness, trousse-galant, small-pox, scarlet fever, with malignant sore throat; measles, with mumps.

Of these pestilences, *typhus* has the precedence as the earliest recorded, so remote, indeed, as the Saxon era, when the Danes devastated the land; then again after the Conquest, as told by Vitalis and others—the whole of these visitations being *famine fevers, which are typhus;* and, as Speed informs us of the reign of Henry III, in 1235, "As those continued turmoils, and *plagues of the sword*, much afflicted the land, so this was the third yeare wherein God inflicted also for sinne, the *plague of famine*, whereby the poor did miserably perish"; and as it is related in the *Antiq. Britan.*, later in the same reign, 1270, "that provisions were so scarce that parents did eat their own children, and thousands died on the highways from starvation." These, and many other epidemics, although less extensive, must be regarded as the severest form of typhus.

Similar occurrences were recorded in 1521, when, according to Sir Thomas More, the farmers were driven from their farms by oppressive taxations, "without knowing where to go", and a severe famine resulted, with fever, in London; and later, in the rebellion of 1549.

Besides these, there were great epidemics of fever in London in 1314, 1379, 1478-9, 1481, and with it a great plague in 1499-1500, when the king, with his court, fled to Calais; that called English fever, in 1555, 1580, and 1645; that called pestilential spotted fever, in 1505, 1528, 1626, and 1643; in 1546-47, a delirious fever with pestilential flux; in 1586, ship fever; and in 1602 the Hungarian, or camp fever; malignant fever in 1612; depuratory fever, with abscesses and furuncles, 1661-64, just preceding the last Great Plague.

These visitations, when they were not of the plague, may, I think, be pretty safely assigned to our types of typhus, typhoid, and synochus, although it is possible that the first two of them, following the Black Death of 1348-49, may have been recrudescences, with intervening series of minor manifestations of it, as we shall find when dealing with the plague of the seventeenth century. But it is significant that, from the beginning of the sixteenth century, exanthematic typhus extended over all Europe, and that, so late as 1845 to 1848, was the more general type of the famine fever that devastated Ireland, and is always ready to rise again from similar causes.

The next pestilence in order of succession was the great plague of the Levant, of which the first eloquent record is from the pen of Cantacuzenus, Emperor of Constantinople, an eye-witness of it. It was a fever, a true pandemic, that was preceded by, and which left behind it, a long-enduring progeny of epidemics. It came in among the Ottoman Turks, who were invited by Cantacuzenus to his aid at that time against the Palæologi, 1347. From Constantinople it spread along the shores of the Mediterranean; and, according to Barnes, the historian of the reign of Edward III, "it destroyed nine of ten through the whole world." In August 1348, it reached the western seaport towns of England, and extended to London about the 1st of November in the year after our capture of Calais. Of this we are informed by Stow, "that it overspread all England, so wasting the people, that scarce the tenth person of all sorts was left alive, and churchyards were not sufficient to receive the dead. For this reason Ralph Stratford, Bishop of London, bought thirteen acres of land called No Man's Land, and added it to the ancient Pardon churchyard lying on waste land northwards to St. Paul's; and in the same year, 1348, Sir Walter Manny purchased another No Man's Land—now the Charter House—and devoted it for a cemetery to those who died of the pestilence, of whom more than 50,000 were buried in it, and the whole mortality in London is generally reputed to have exceeded 100,000."

Speed writes of it: "It rained from Midsummer to Christmas, and so terrible a plague spread through the world, that the earth was filled with graves and the air with cries, which was seconded with murder of cattle and death of all things. The plague began among the Turks."

Through three centuries and a half subsequent to the Black Death the plague was never absent from continental Europe, and therefore it may be supposed that it was likewise present in England, more especially in London from its dimensions; and that many of the so-called pestilences with which it was afflicted were really of the plague, although not definitely so called. Generally, there were epidemics commencing in unhealthy cities, and infecting the towns and country around to a greater or less degree; but there was never again such a pandemic as that of the Black Death. Historians have asserted that in the sixteenth and seventeenth centuries epidemics of plague ravaged London once in twenty years, or oftener; and, as in the seventeenth century sporadic plague was rarely absent from the city until its final extinction, the same may be assumed of it from its origin in 1348. The next recorded recurrence of the plague in London was that of 1499-1500, in the reign of Henry VII, when it took off about 30,000 of the citizens, and the king, with his court, fled to Calais for safety. In 1504 it overran England; and the next year a spotted malignant fever followed it in London—as a daughter: that being the first announcement of that type, which, as spotted fever and the purples—sometimes alone, but generally attendant on the plague—was endemic in London through the sixteenth, seventeenth, and the first half of the eighteenth centuries, one century after the plague had disappeared from the Bills of Mortality.

During the hundred years' war and the War of the Roses, as well as those of the sixteenth century, there were great checks to national progress, so that at the end of that period the English stood inferior to Continental nations in the resources of civilisation through the sciences and the mechanical arts, in cultivation of the soil for more than corn and fodder, and in all the domestic comforts and luxuries. Linen was not commonly worn, and soap was first made in England in 1524. The diet was of flesh and fish, salted in winter, with coarse bread, peas, butter, and cheese, with beer for drink. By droughts, tempestuous weather, and vicissitudes of the seasons, murrains were induced, and these were duly followed up by famines and their attendant fevers, since the loss of cattle involved scanty tillage, with much lying in fallow, and their successive harvests ran short. The price of

corn would count extremely high in the summer, and then fevers would arise, all of a very adynamic type, from want of food; but when the crops were garnered, then the public health was restored, although three years may have been passed in want and affliction of dire amount. Epidemics of plague were frequent, and new infectious diseases arose, which were at first observed in the crowded cities and towns, from which they were disseminated into the farms, until the whole country was overrun and decimated; as in the Black Death, which left scarcely one in ten alive; or in the Famine Fever of 1314-15, which left scarcely enough alive to bury the dead; and that of 1270, when thousands perished by the roadside, and when it is recorded that parents devoured their own children. Of newly developed epidemic diseases there were malignant, spotted, typhus; the English sweating sickness, that at first carried off its victims usually in twenty-four hours; and the trousse-galant, or "cholera-morbus", that was equally rapid in destruction of life.

Physicians stood aghast, or decamped from scenes of which they had had no experience. Medicine was no helper, and its professors were but few; for London, with its 100,000 inhabitants, could count but thirteen of them in 1513. If it were so in the oft-stricken metropolis, who can imagine the horrors in provincial towns and country places?

The helpless populace, in their despair, were taught to believe that the Giver of all good gifts directed pestilences as ministers to avenge the misdeeds of His creatures, so as to bring them to more devout communion with Himself. It was deemed almost a sin to oppose, by human agencies, the imputed will and purpose of the Divinity in permitting disease and death to rule for a season, during which unwise measures were relied on to check the progress of the fatal disease. Instead of house-to-house inspection, there was, by orders of the Privy Council, a quarantine on infected houses, marked, as a caution to passers-by, with the pious exclamation, "Lord, have mercy upon us!" and a cross on the door, the colour of which was rated of importance, as it was ordered by Queen Elizabeth to be of blue, and by Charles II, of red colour. Depressing as such measures were by day, those of the night were more so, for then the streets resounded with the rolling of cart-wheels for carrying away the dead, to the melancholy cry of "Bring forth your dead", which were interred within the walls till the churchyards could hold no more.* On each occasion of an epidemic of plague, the cold

* In 1580, a Royal Proclamation was issued against new buildings within three miles of the gates of the City, and prohibiting the letting

of winter stepped in to cut it short for a season, but not to extirpate it, as year after year it showed itself again at the end of the spring. The outburst of 1603 was thus carried on annually until 1611, and every year there were tens of cases, until another great epidemic befell in 1625, which dwindled to no recorded death in 1629, and recrudesced with 1,317 deaths in 1630, and fell to none in the years 1633 and 1635. Such a freedom from plague had not been recorded in the seventeenth century; but in the succeeding year it came in force so great that the epidemic was not expended till 1648, and London was not without some recorded deaths annually, although at very low ebb in 1663 and 1664, with nine and six respectively, when it burst out with extreme virulence in 1665, when the Dutch fleet was at our doors, and it carried off, as Clarendon and others credited, no less than 100,000 of its inhabitants. In the following year there were 1,998 deaths, when, happily, the city was in flames. That necessitated rebuilding, or the same course of events would, in all probability, have recurred as after the outbursts of 1603, 1625, and 1636. For, even granting that on each of these occasions there was an importation of fomites from the Continent, yet that was only like the spark struck off into a tinder-box.

Now, it may be reasonably thought that if such was the course of events in the seventeenth century, of which all we know of the health of the city of London is from public records, may it not be credited that a similar state of things did exist, but unrecorded, in the preceding and still more remote ages?

The Bills of Mortality from 1603 to 1665—sixty-three years inclusive—show a total of burials of 864,656, and as the deaths by plague in the same period were recorded at 186,491, it follows that the ratio per 1,000 of these amounted to 215.7, including four great epidemics. The number of deaths from fevers, in twenty-seven years of the same period, being 70,154, their corresponding ratio was 161.7 per 1,000 in a total of 435,216 deaths.

of houses within the walls to more than one family. But among many more reasonable orders, such as to keep corpses out of churches and to allow of no wakes, this is inserted, "Skilful and learned physicians may be provided to minister to the sick." In 1641, a Parliamentary Proclamation sets forth, "The house visited with the Plague to be shut up whether any person therein do die or not: And the person so shut up to bear their own charge, if they be of abilitie. No person to be removed out of any infected house, but by leave of the Magistrate. If any person shall flee out of any house, at the time when the said house shall be infected with the Plague, such person so fleeing to be pursued by 'Hue and Cry', and the house where they should be found to be shut up, and they restrained in some such place as the Magistrate of the place where they shall be found, shall think fit."

Sydenham, who was the first to elaborate a general view of fevers, and to classify them definitely, considered them all to arise from some disorder or change in the crasis of the blood, from a commotion, or an inflammation, or a fermentation set up in the vital fluid to rid itself of some peccant matter. Thus, all those of intermitting or remitting types depended on a commotion in it; plague, and its satellite, pestilential fever, with blind furuncles which were called plague-tokens, without buboes, on an inflammation of it, which in bubonic plague affected the solids, *i.e.*, the corpuscles and the fibrinous particles, but which in the pestilential fever touched only the serous fluid. Besides these there were the exanthematous class, in which he assigned to each its special fermentation and ebullition, to throw off the "fomes" that were the essence of the disease. Thus it was that he marked differences in the fever accompanying and preceding the eruption, and wrote of variolous, dysenteric, and erysipelatous fevers, all, together with that of the plague and its pestilential fevers, being normally of the synochal type. The term putridity he gave to the secondary fever of confluent small-pox; and malignancy in any fever he attributed to unskilful practice; and to those that seemed to purify the mass of the blood he gave the name of depuratory fevers.*

The next special pestilence in London was the *sweating-sickness*, called the English-sweat by foreigners, because it was always disseminated by Englishmen. Caius styled it *Ephemera Pestilens*, or the One-day Pestilence, in his, the first professional account of it, published in 1552. It was brought into England amongst the irregular adventurers that made up the 3,000 fighting men of any nation who came over with the Earl of Richmond in 1485 to assert his claim to the crown of England. These vagrants were men of the stamp that were accustomed to generate ship and gaol fevers through the next two centuries.

They landed at Milford Haven on the 7th August 1485, after a crowded, ill-provided voyage of seven days, where they were joined by 2,000 Englishmen, and marched onwards, sickening by the way, till they encamped at Lichfield on the 18th (170 miles).

The battle of Bosworth was fought on the 22nd, and immediately after it the disease appeared in the army, of which scarcely more than the infected Englishmen reached

* Major Graunt's *Observations on Bills of Mortality*, chap. iii, Observation 38. Agues and fevers are entered promiscuously, yet in the few bills wherein they have been distinguished, it appears that not above one in forty of the whole are agues. Printed in A.D. 1664.

London, after a march of four days. The pestilence went thus very speedily through England, and grievously infected the city; and Holinshed chronicles of it that "scarcely one amongst an hundred that sickened of it escaped with life, for all in a manner, as soon as the sweate took them, or within a short time, yeelded up the ghost." It appeared in London on the 21st of September, and ended in about five weeks, affording no security against a second or third attack with equal violence.

Whilst the physicians stood appalled at this fearful unknown malady, the commoner sort of people found out for themselves a secure mode of treating it by ptisans and moderate warmth in bed, until the sweating stage was over. The epidemic passed away as quickly as it had come. Later epidemics came in 1506, 1517, 1528, and in 1550, after which it never appeared again. Speed writes of it on the last occasion, which was eight years after Caius had published his account of the nature of the disorder, thus: "This disease is not a sweate only (as it is thought and called), but a fever, as I saied, in the spirites by putrefaction venemous, with a fight, travaile, and laboure of nature againste the infection recevyed in the spirites, whereupon by chaunce foloweth a sweate, or issuith an humour compelled by nature, as also chaunceth in other sicknesses which consiste in humours." The words of Speed are: "After which calamities" (defeats in France, with the surrender of Boulogne) "a great and mortall disease followed, namely, the sweating sicknesse, that raged extreamely through the land, wherein dyed the two sonnes of Charles Brandon, both of them Dukes of Suffolke, and nephews of Henry the VIII, besides an infinite number of men in their best strengths, which followed only Englishmen in foreigne countrey, no other people infected therewith, whereby they were all feared and shunned in all places where they came." From this it would seem to have originated amongst King Edward VI.'s army in France, and to have been brought across to England by them, as it had been in 1485 by the Earl of Richmond's rabble-rout of mercenaries. Let the idea of infection be abstracted, and this remarkable disease bore the characteristics of a violent special type of miasmatous fever, that attacked alike all classes exposed to its causes.

It is remarkable that within this era of the sweating-sickness epidemics there occurred in London, in 1542, a severe epidemic of hot agues and fluxes—whether or not allied to it, in public opinion, it is not, however, stated; and there was also in 1544-45 a new disease brought from France, to which

the name of "Trousse-galant" was given. It may have been a severe form of choleraic fever; but that is uncertain.

Hecker was of opinion that it was a highly inflammatory fever, which destroyed its victims in a few hours; or, if they escaped with their lives, deprived them of hair and nails, and left them with a loathing for all animal food, inducing extreme debility. It seems also to have turned into the "verminous fever" of our own authorities, not heard of till then.

In 1545 London was afflicted with a great plague. It is certain that between 1518 and 1545 was a very troubled period of the reign of Henry VIII, and that in 1544 that king invaded France with an army of 30,000 men to assist the Imperialists. Although Boulogne was captured by the English, yet they returned home "in a sorely impoverished condition", and the invasion was short. There had been an invasion of France in 1522-23, when the Duke of Suffolk retreated when near to Paris; and also an invasion of Scotland in 1542, under a Duke of Norfolk, who defeated the Scotch in the Solway Marshes.

Besides this, the whole period was one of civil distresses at home; in it the last of the Plantagenets were cruelly beheaded, the supremacy of the Church was taken from the Pope of Rome and vested in the king, who then suppressed all the religious houses, which were the only places of succour to the poor and destitute and suffering, thereby increasing the poverty of the nation, when agriculture stood at its lowest ebb. In the last ten years of the period the king had five wives, two of whom he divorced, one he beheaded, one died in childbed, and the last survived him by chance; and it is said that in his reign 70,000 were hanged for theft alone.

Under these political, social, and domestic troubles, wherein all, from the nobles to the meanest of paupers, were undergoing changes and uncertainties—for nothing was stable—when the monarch himself, born to immense treasures which he had expended on schemes of ambition, was subsisting on wrenched-out contributions, it is not to be wondered at that there were frequent epidemics that decimated not only the metropolis, but the country at large; and yet this was destined to be the chaos out of which the United Kingdom of Great Britain was finally to emerge.

On the continent there was no repose through the first half of the sixteenth century, when great questions were being submitted to the arbitrament of the sword, placing Europe on its modern basis: it was an age of revolutions and

organic changes, and amidst so many things that were new, there were even new types of diseases, all of the typhous character, and some of these were casualties that came and went again, whilst others left their stamp in the most prevalent epidemics of fever in later times.

The newly discovered continent of America was then but a property of the Spaniards, who in it made themselves masters of more productive gold mines than the world had ever before possessed, causing a great rise in all commodities and the necessaries of life: hence arose scarcity and poverty, the parents of adynamic diseases.

This new possession was a part and parcel of the new empire—the greatest Europe had seen since the days of Charlemagne—which was developed in an almost fortuitous manner through the decay of dynasties, that placed many crowns on the head of one capable monarch—the Emperor Charles V, who was a nephew of our King Henry VIII, by his marriage with Katharine of Arragon, a daughter of Ferdinand and Isabella, the grand-parents of Charles; and thus England became involved in the wars on the continent of Europe.

Of these there were four between France and Germany with Spain, in which Francis I, another grand monarch, disappointed at not being elected emperor, contested the kingdom of Naples, and was at length worsted by the outbreak of a pestilence in his camp before that city. Besides that, there was the invasion of the Turks, who advanced as far as Vienna, and besieged it, when they were terribly harassed by the English sweating-sickness, causing, perhaps, greater losses than were suffered by the sword.

Then there was—a new disease—the "trousse-galant", that was so called because it carried off the young and most robust in a few hours, with intolerable sufferings, which in its accession was choleraic, and seems to have given rise to the word "Cholera-morbus", which, if outlived, turned into a typhous fever, with a miliary and petechial eruption, and inflammation of the brain, that induced Sauvages to classify it as *Cephalitis Verminosa*, there being frequent evacuations of ascarides.

In 1545-6 there was war between England and France. Boulogne was captured and retained by treaty, after being besieged by the Duke of Orleans, the second son of Francis I, who died there of this disease, by which the besiegers were entirely cut up, being destroyed either in a few hours, or dying on the fourth or eleventh day. The 10,000 English defenders of it, it is said, suffered so much that they were

compelled to leave the town, and pitch a camp outside the walls, and the reluctant reinforcements felt that they were encountering sudden death. The disease was brought to England, and it may be supposed, to London, as Dr. Short notates that, in 1545, the trousse-galant overran France and England, and that Verminous fevers, a speciality of it in France, were prevalent in England. It was credited that in France, in 1548 and the following years, it carried off one-fourth of the inhabitants; after which it appears not to have returned epidemically.

In the first edition of the *Dictionnaire de l'Académie* it is defined—"a kind of violent disease which destroys quickly, and which is commonly called 'Cholera-morbus'. It is antiquated." It is remarkable that this definition was pronounced so long before the Asiatic cholera, which it resembles so closely, was heard of in Europe.

It was in the same epidemic cycle that another new disease appeared in Holland, according to Dr. Hecker, in 1517, and once more in 1557. On the first occasion it was preceded by "a thick, stinking fog, that for several days spread over the land". He styles it to have been a laryngo-pharyngeal affection of the most deadly nature; and we may accept as the same with the pharyngeal croup of writers previous to M. Bretonneau, who, in 1823, first designated it "diphtherite", and we diphtheritis.

At the same period the Germans were greatly afflicted by a low fever, with inflammation on the brain or its membranes, which appears to have been endemo-epidemic, and may have been induced by the great poverty consequent on, with the intensity of the mental and spiritual excitement inseparable from, the religious contentions of its armed enthusiasts, every man of whom pinned his life to his faith and religious opinions, and was ever ready to rush into deadly battle, keeping up its excitement and its terrors, from 1517, when Luther nailed up his theses against the sale of indulgences on the door of his church, until 1552, when the Protestant faith was secured by the signature of Charles V to the treaty of Passau.

We ought not to pass onwards without referring to another disease—the plague of immorality—which was one of direct contagion, by vicious contact alone, and not of infection of the atmosphere or of contagion otherwise, as those new epidemics already spoken of were; and which, unlike those that passed away and left no trace behind, has left its deplorable results from generation to generation impressed on man, and has brought upon him a dire category of his modern diseases.

Possibly this disease may have been a plague the Hebrews carried with them out from Egypt, against which the grandest and the first of all sanitary codes directed its wonderful, and often effectual, measures of prevention. But from that time history has no record of its having had any epidemic force until within the cycle we are now discussing, and it assumed that type in the last decade of the fifteenth century. Some have believed that it was introduced from America, and others from Africa, being there the yaws of negro races; and that, in any case, it was the Spaniards who brought it into Europe through Spain and Italy; but others have asserted its presence in Europe at earlier dates. However that may have been, it was first an epidemic in the allied Spanish-Italian camp besieging the French in Naples in 1495, and was dispersed widely on the cessation of the siege. It was said to have been in Paris in 1494, and in Edinburgh, which then held intimate relations with Paris, in 1496. It is not stated when it was first noticed in London, but it was probably about the same period. It received the name of *Morbus Gallicus* from the Italians, and of *Morbus Italicus* from the French; in our vulgate it was the French pox always, but technically *Morbus Gallicus;* then *Lues Venerea* from 1675, and Syphilis from 1800.

The earliest treatment of the disease was by guaiacum, the knowledge of which was derived from the natives of America—this was the Galenical treatment; but from Paracelsus, who was born about the year of the reputed introduction of the disease from America, the chemical therapeutics were derived, and the use of mercury was taught in England by G. Baker, in 1775. But Wm. Clowes, who served both in the navy and army of Queen Elizabeth, published a small book, *De Morbo Gallico,* in 1585, giving that treatment to salivation by what corresponded to our modern grey-powder and blue-ointment; and from his remark on Baker's *brochure,* it may have been first the practice of some earlier writers in English, and translated into French by M. Traheron (fol. iii, cap. 21), and reduced into English by Baker.

There is evidence that this foul disorder appeared epidemically in Italy, from which it flew apace through the nations of Western Europe; but from that time it may be said to have been domesticated in all civilised states.

The Exanthematic Fevers.—When we consider that up to the middle of the seventeenth century rather less was known of these highly contagious and infectious diseases than the Arabian physicians taught in the tenth century, since they

wrote of small-pox and measles being distinct diseases, whereas, with us, Sydenham was the first to discriminate them in practice, about 1674; and that scarlet fever was not diagnosed from measles before 1796, by Withering; surprise disappears that so little is known of the mediæval history of this group of diseases, which may be supposed to have been frequent in those times, although not diagnosticated.

It is for the same reason that, so far as that long period is concerned, they must be considered collectively by us, and what is said of the group must be taken to apply to a medley of diseases, confounded and uncertain, so far as concerning their history in that of Old London.

French authorities have asserted that small-pox was known in France in the sixth century, and that two of the family of the Merovingian King Dagobert died of it: which would imply that it might have been a Western epidemic about 630 A.D.

The first distinct account of it was by Rhazes, an Arabian physician, who was born about 852 and died in 932 A.D. He and other Arabian writers assert that small-pox and measles made their appearance in Arabia about the same time, near to the birth of Mahomet, which took place in 570, and that they were carried to Egypt in the army of the Khalif Omar, A.D. 638. The next attempt at conquest in North Africa was in 647, in the reign of Othman, when the Saracens, having won a great battle at 150 miles south of Carthage, with great slaughter, a great epidemic decimated their army, and compelled its retreat to Egypt. Thus the conquest of Barbary was deferred until 667, owing to a destructive epidemic; and as the plague-bubonic would seem to have been then unknown to Rhazes and other Arabian writers, will it not be reasonable to assume that the epidemic was one of small-pox? To continue the route of the disease into Europe with the Saracens, who conquered Spain in 714, we have reached a date about eighty-five years later than it is said to have been present in France; from either of which sources it may have made its way into England, of which the latter would appear the most probable.

On the authority of Dr. Gregory, we have it that there are in the British Museum some monkish MSS. of the ninth century, in which the word *variola*—diminutive of *varus*, a pimple—is to be found; and, therefore, in Anglo-Saxon, variola becomes *small-pock*, as the vulgar name for it then known in England, and, of course, known in the great centre of commerce with the Continent, and with France and Belgium in particular.

The diminutive name might have been applied to a milder form of pock than some other already well known, possibly a more severe type of eruptive fever, since extinct; or it may have presented itself in the discreet form only, of which Sydenham wrote so late as 1676, "that it is in no wise dangerous in itself." Again, as in more recent times, it must have appeared epidemically in combination with other forms of malignant diseases, as typhous fevers, and have been then grouped up in one pestilence, as the chroniclers usually characterised any very great mortality. However that may have been, I have not met with a distinct record of an epidemic small-pox in London earlier than 1614.

Previous to 1629 the Bills of Mortality gave only the numbers buried, and from that date there was a formula giving the diseases and casualties of which they died, in which flox and small-pox were together till 1702; measles standing alone till 1687, then combined with the above till 1702, when flox was omitted, and small-pox and measles were separated. What flox represented is not clear; but the facts indicate the uncertainty reigning up to 1702 with regard to the classification of measles, in which year there were several modifications in the Bills of Mortality of names and places of diseases.

It must be borne in mind that the Bills of Mortality were merely the exponent of the vulgar diagnosis of fatal diseases, as obtained by old women searchers, and tabulated by the parish clerks. Incorrectness or inexactness in popular views of epidemic diseases is excusable, whilst so much of uncertainty possessed the mind of the profession concerning them; for small-pox and measles were looked on by most as the same disease when Sydenham wrote his *Medical Observations* in 1676, although they had been reported as distinct diseases, in the Bills of Mortality, since 1629. Again, with regard to scarlet fever, which was referred to, and its squamous exfoliation mentioned, in the same volume, yet that eminent physician must have held an indefinite opinion of its etiology when stating that it arose "from the heat of the preceding summer, or from some other exciting cause", which shows that he had no idea of its highly specific character. Now, scarlet fever first appeared in the Bills of Mortality in 1700, yet it has been said that its distinction from measles was not placed beyond a doubt till Dr. Withering's essay on scarlet fever and sore throat appeared in 1778; the febrile symptoms being regarded as secondary and dependent on the local inflammation of the throat; and there can be no doubt that

epidemics of scarlet fever have been dealt with as those of malignant angina.

There was certainly an abnormal number of deaths by quinsy and sore throat, which having long been diseases of rare fatality, is suggestive that they were then, for the most part, results of the scarlatinous poison, which was not then recognised as of a specific nature.

On the relations between mortality from small-pox and measles, it happened not always, but quite as often as not—the general scale of increase from 1629 being equal, with the former disease far in advance—that its epidemic years were marked by a diminished frequency of measles, which showed their maxima in the years preceding and succeeding that of the small-pox.

After the great epidemic of 1614 there were under a hundred deaths a year, until 1633, when these mounted to 531, and to 1,354 in the next year; and were seen at 1,190 in 1649, at 1,279 in 1652, at 1,294 in 1655, fluctuating much betwixt those dates, and presenting a much increased number in the year previous to the climax, and after it a sudden fall.

By comparison of the statistics of small-pox in the first half of the seventeenth century with those of about the same years of the eighteenth century, when plague had become extinct in London, it is found that for the former period, when the plague was very active, the statistics afforded by Major Graunt for twenty years, were of total deaths 229,250, and of 10,676 deaths by fever and small-pox, which gives 46½ per 1,000 of total deaths, when the statistics of Dr. Corbyn Morris, likewise abstracted out of the Bills of Mortality half a century later than the plague, are total deaths about 750,000, with 51,000 by small-pox, which gives 69 per 1,000 for a period during the last ten years of which inoculation stood firmly established, and was largely practised in London. This inference may be drawn: so long as plague held its ground, the exanthemata were usually in abeyance; but when the plague became extinct, then the exanthemata increased in amount and possibly in mortality, relatively to the total mortality from all causes.

This may be placed in a still stronger light by excluding the mortality by plague altogether, as a mere casualty, and then it is found that in the first half of the seventeenth century the small-pox filled 50 per 1,000 of the graves, and that in the same portion of the eighteenth century it took up 69 per 1,000 for its victims.

And in pursuing this momentous question further, until the end of the eighteenth century, when inoculation was in full

swing as a prophylactic from the confluent form, it is found that in the last ten years of that century the proportion was increased to 92 per 1,000.*

It is highly significant of the manner in which these pestilences interlocked with each other, sometimes two or three of them co-existing in the same year. The great plague of 1603 kept up its burials of thousands until 1611, when they were of hundreds, and then sank to tens or to digits until 1625, when another great epidemic occurred. Within that easy period, so far as plague is concerned, there was an epidemic of malignant fever in 1612; a pestilential small-pox in 1614, repeated in 1621; and an epidemic of measles and mumps, said to have been as destructive as the plague itself, from 1622 to 1625, when it was succeeded by the epidemic of plague that lapsed into the pestilential spotted fever in 1626.

Another point brought forward by the Bills of Mortality is, that a deficiency in the vegetable diet of Londoners may have conduced to debility that may have rendered them more susceptible of contagion or infection. From 1629 to 1750 scurvy was a direct cause of death, and as that disease is so rarely fatal ashore, it may be inferred that a few deaths from it indicate a wide spread of the diathesis. The deaths by it were numerous up to 1690, after which they fell rapidly in number, so that up to 1750 they rarely touched the proportion of 0·1 per 1,000, *i.e.*, of one in ten thousand of total deaths, which proves the advance of horticulture between the reigns of Charles I and George II.

Mr. President and Gentlemen, I shall now endeavour to present to your notice a crude arrangement in cycles, or eras, of those epidemics that have been recorded in London, sometimes in it alone, and sometimes in great part over the whole of the country.

1*st Cycle.*—From the ninth to the end of the thirteenth century, embracing the periods when the eastern and southern counties were constantly harassed by the Danes; that of the Conquest and its terrible sequences; that of the wars between king and nobles, when the face of the land became dotted with castles and strongholds, around which the serfs or cultivators crowded for safety, not daring to wander far from them to plough the soil. Then were the crusades, the wars in Ireland, Wales, and Scotland, all of which diminished the productiveness of the fields by the abstraction of hands. The often-repeated famines arose from these causes; and with

* Approximate Table in Appendix.

famines and murrains there came a fatal train of fevers, all adynamic, from want of food.

2nd Cycle.—From the middle of the fourteenth to the latter part of the fifteenth century, in which there was no internal improvement at home, whilst the flower of the manhood of England—nobles, yeomen, and freemen—was drafted, through a hundred years, under the banners of heroic kings and princes, to fight or to die on the field of battle, or to perish by epidemics or by slow diseases in their camps, in vain attempts to establish claims to the crowns of Scotland and of France.

In the year after the fall of Calais, the plague of the Levant showed itself in Western Europe, spread to England, and caused 100,000 deaths in London alone, and perhaps was never extinct until the city was burnt in the year 1666. After the French war came the domestic War of the Roses, that sprinkled our own fields with blood, and caused neglect of their cultivation.

3rd Cycle, was that of the Tudor period of our history, in which the foundations of modern England were laid amid wars with France, and Spain, and Holland, with abject tyranny, rebellions, revolutions, and civil wars at home, that cleared away the mists of the past, and ensured to England a rich and glorious future. During that cycle diseases hitherto unknown appeared, possessing a kind of national individuality. Of these there was, first, the English sweating-sickness, that made five distinct epidemics between 1486 and 1551 in London itself, not always, if ever, spreading into Scotland or Ireland, as it did to Hamburg in 1529, from which it infected the banks of the Rhine and central Germany to Vienna, where the besieging Turks suffered from it in 1529, and Denmark, Sweden, and Norway. 2nd. The Spanish, and Italian, and French epidemic type of Syphilis, that burst out in their camps at the siege of Naples in 1494, greatly influencing the event in that memorable siege ; and after that it was dispersed rapidly through the mother countries of the various armies engaged, and very soon appeared in the capitals of Europe, including Edinburgh and London, and has since become a scourge of mankind. 3rd. The specially French " trousse-galant", a sort of choleraic fever or " cholera-morbus", just as deadly as the English "Sudor-Anglicanus". There were three visitations of it, the second of which occurred in 1545. In that year, King Henry VIII having invaded France with an army of 30,000 men in July, captured Boulogne in September, and quickly returned home " sorely impoverished". This disease having appeared in the

French camp, infected that of the English, with great loss of life. It was then imported by the soldiers to England, where it spread over the country. It never reappeared in England, but it continued in France several years. 4th. A disease of the diphtheritic type—a mucous-laryngo-pharyngitis—appeared in Holland in 1517, when the sweating sickness prevailed for the third time in England; it was very fatal, with rapid course, and it reappeared again in Holland in 1551, but not after. That year afforded striking instances of a correlation of various forms of epidemic diseases, concerning which Dr. Hecker writes: "that the English sweating-sickness of 1517 made its appearance not alone, but surrounded by a whole group of epidemics, and that these were called forth by general morbific influences of an unknown nature." And again, of this cycle, he writes: "It was a century of *putrid malignant affections*, in which the typhous diseases were continually prevailing—a century replete with grand phenomena affecting human life in general, and continuing long after the period to which our researches refer."

The dynasty of the Tudors, covering a hundred and eighteen years, 1485 to 1603, came in with the sweating-sickness, quite a new disease in London, and went out with a severe epidemic of plague. In its course, London suffered four great epidemics of plague, and five minor visitations of it; of the sweating-sickness, five epidemics; of famine fever, three; of spotted typhus, called English fever, four; of that called ship fever, and camp fever, two; of choleraic fever, one; of hot, burning intermittents, with dysentery, one. In fact, the City was a hotbed of plague, typhus, and adynamic fevers in general, and dysentery, throughout this cycle; and on three occasions it was deserted by the reigning monarch, on account of highly infectious diseases.

4th Cycle covered just the first half of the Stuart dynasty's rule, from 1603 to 1666. It was ushered in, in London, badly, by crowning a king in the midst of a severe epidemic of plague; in its mid-course it was the centre of a great political revolution; and its end is signalised in history for ever by a superlative epidemic of plague that destroyed nearly a hundred thousand of its inhabitants; and in the following year the habitats of that disease were destroyed in a grand conflagration of nine-tenths of its wood-built houses, out of whose ruins there rose a city with wider streets, sewered, and its houses built of stone and brick. It may now be said that the wooden walls of an old hospital ship are not more

saturated with the germs of contagious and infectious diseases, than were the older wooden walls of the dwelling houses of Old London previous to the Great Fire. In this last cycle that lies within the scope of this paper, out of sixty-three years there were only three years without deaths by plague, of which there were four great epidemics that carried away, as badly reckoned victims, 145,634 persons, that may safely be computed to have exceeded 180,000, with at least 36,000 others in their interims. Besides these vast losses of life, London underwent, in this cycle, epidemics of malignant fever, of typhous-maculated and petechial, in types; and the exanthematous fevers, gathering unwonted severity; had destructive epidemics of small-pox in 1614 and 1629, and of measles with mumps, said to have been as fatal as the plague itself, in 1625.

Gentlemen, I believe that I have presented a fair display of the insanitary conditions prevalent in Old London, and my task is finished. Let me thank you for your kind attention.

A SYLLABUS OF THE EPIDEMICS OF THE LATER MIDDLE AGE, AND OF THE RENAISSANCE AGE, FOR THE MOST PART INFECTING OLD LONDON.

The Era of the Plague in England from 1348 *to* 1666.

Henry III.....	1232-34....	Famine, with starvation and fever, through three years. In London alone 30,000 perished.
	1270	Famine, with starvation and fever. Parents ate their children, and thousands died by the roadsides. In London alone 20,000 perished.
	1314-15....	Famine with great mortality, so that interment was difficult.
Edward III ...	1348	The Black-Death, or plague from Asia. The first in Western Europe. In London alone 100,000 perished.
Richard II ...	1379	A great mortality throughout England.
	1389	After a great murrain, followed a pestilence, with great mortality among youth, everywhere in town and country.
Edward IV ...	1468-70....	Three years of great mortality. In the year 1470, from September to November, in London, a destructive plague.
	1477	A great plague throughout England.
	1479	A great plague in London, in September to November.
Henry VII ...	1486	A new disease of deadly type—*Sudor Anglicus*, or the English sweating-sickness—raged in London and Southern England.
	1496	Epidemic syphilis spread to the British, having shown itself first in the Spanish army besieging Naples.
	1499-1500.	A great plague in London. The King, with his Court, fled to Calais. In London 30,000 perished.
	1502-1504.	The plague in England, and in Germany.
	1505	A pestilential spotted fever, followed after the plague in London, It received the name of English fever.
	1506	The second epidemic of the English sweating-sickness in mild form, confined to London and England.
Henry VIII ...	1509-10....	The plague in London, with a general famine. The young King sent 600 quarters of wheat to the citizens. In 1510 a severe epidemic of influenza spread over Europe.
	1512-13....	The plague and famine in England.
	1515	The plague of pestilence in London. In the Minories convent twenty-seven nuns, with laity and servants, died of it.
	1517	A third epidemic of English sweating-sickness. In Holland, with plague, a very quickly fatal sore-throat, lasted only ten days. Qy. diphtheria.

Henry VIII	1521	A great mortality through England, after scarcity of provisions from a long drought.
	1522	The same spotted pestilential fever as in 1505.
	1526	A great plague in London, causing an adjournment of the law terms.
	1528	A fourth epidemic of the English sweating-sickness, and the so-called English fever of 1505 and 1526, abounded.
	1529-31	English sweating-sickness carried to Calais, where two successive Brandons, Dukes of Sussex, died of it. Dysentery epidemic.
	1538-40	Fatal dysentery and intermittent fevers were very prevalent.
	1543	The plague in London, causing an adjournment of the winter law terms.
	1544	A new, very fatal disease, called the "Trousse-galant", brought into England from France. "Cholera-morbus", followed by fever.
	1545	After the "Trousse-galant", verminous fevers, universal influenza, both fatal to youth, and also the plague, present in London.
Edward VI	1546	The plague, with pestilential, delirious fevers and diarrhœas.
	1548	Pestilential peripneumonies, spread from week to week over Europe.
	1549	Famine and a pestilential fever year in London.
	1551	The fifth and last sweating-sickness began at Shrewsbury and extended to London.
Mary	1555	Epidemic of the English spotted fever (pestilential). Same as in 1505 and 1522.
Elizabeth	1557-58	A long epidemic of hot-burning agues and remittents, with great mortality, in autumn of 1558. The two following years seasonable and healthy.
	1562-63	A great plague in London, with the country keeping healthy. A blue cross ordered on infected houses. Deaths in London, 20,136. In 1563 it spread widely in the country. A pestilential sore-throat overran most of the Continent.
	1566	The Hungarian camp-fever first spoken of.
	1568	The plague in London.
	1573-74	A great dearth of food in the first year, followed by a small plague. The theatres were then closed for the first time.
	1580	An epidemic of the English spotted-fever. Plague was said to have carried off 500,000 people in Cairo.
	1582	The plague in London. The Queen moved out of Norwich Palace to Richmond, and thence to Oatlands. The law terms adjourned for the winter.
	1586	Camp- and ship-typhus, called Hungarian fever, brought by the fleet from Lisbon. Spread over all England.
	1589	Great heat and drought. Plague in London, Lichfield, and Leicester. In summer many spotted tertians and quotidians.
	1592-93	A great plague in London, of which there died 17,890 persons.

James I.....	1602-1603.	First year, influenza; and, in 1603, a great plague in London, of which 30,158 persons died, and 9,000 more in the following nine years.
	1610	The Hungarian camp-fever spread in England by soldiers returned from Alsace.
	1612	A malignant fever in England.
	1614	A general epidemic through England of a pestilential small-pox.
	1621	The small-pox epidemic, and very destructive of persons of all ages.
	1622-25....	An epidemic fever, measles with mumps, of virulence scarcely short of the plague. It ended in London in 1625.
Charles I	1625-26....	A great plague in London, of which 63,000 died. In 1626 it changed to the pestilential spotted fever; and then, after 1628, the health of London was extraordinarily high.
	1636	A great plague in London, of which 10,466 died, and 17,850 in the following thirteen years without interruption.
	1643	The pestilential spotted fever of plague in London.
	1645	Epidemic of the English pestilential fever and malignant dysentery widely spread; the plague of 1636 being still present in London. 1649, Epidemic of plague ceased.
	1656	The small-pox and the dysentery very prevalent.
Charles II.....	1661-62....	The inflammatory, depuratory fever of Sydenham very prevalent in London.
	1664	A year of abundant crops and harvests.
	1665	The fifth great plague, which, according to Clarendon and others, may have carried off from 90,000 to 100,000 victims.
	1666	The Great Fire of London, which destroyed nine-tenths of the city, with very small loss of life by casualties.

This Table is compiled chiefly from the writings of Dr. Short, on the Increase and Decrease of Mankind in London, together with quotations from chronicles and general histories.

A Scheme of Approximate Ratios per 1,000 *of all Deaths from Plague, Fevers, Small-pox, and Measles, between* 1629 *and* 1880, *displaying the stages of Increase, Variation, and Decrease, at typical periods.*

FROM THE BILLS OF MORTALITY. | REGISTRAR-GENERAL.

	Era of Plague Epidemics.			Neutral Era.				Era of Inoculation.		Era of Vaccination			
										Voluntary.		Obligatry.	Cmpulsry.
Periods Inclusive.	1629-65.	1629-36.	1647-65.	1690-99.	1728-1757.			1780-89.	1790-99.	1820-29.	1830-39.	1841-50.	1870-80.
Plague and Fevers	199.35	169.15	243.82										
„ „	321.70	293.50	363.75										
Fevers	121.70	124.50	119.90	170.	...	...	...	128.25	109.90	39.78	55.76	39.90	16.41
Small-pox	39.50	26.90	43.50		66	80	95	63.66	86.94	34.42	43.72	16.85	19.63
Measles	2.50	2.45	2.60		Min.	Mean.	Max.	12.05	9.44	33.14	36.85	25.06	22.65
Small-pox and Measles	42.00	29.35	46.10	51.10				75.70	96.38	67.56	80.55	41.90	42.28
Ditto,ditto, and Fevers	163.75	151.60	166.00	222.				203.85	206.45	107.35	136.35	80.90	58.70
Ditto, ditto, ditto, and Plague	363.	329.30	409.80		1737-42	1728-57	1752-57						

Some points of chief interest as being reciprocally elucidatory.

1679. The last case of plague in London, it never having shown epidemic force in the rebuilding of London.
1721. The first variolous inoculation in London and in England.
1746. The Small-pox Hospital established in London, for inoculation of the poorer classes.
1754. Inoculation approved of by the Royal College of Physicians.
1798. Vaccination announced and practised by Dr. Jenner.
1801. The first decennial Census taken, being the foundation of Vital Statistics.
1809. The National Vaccine Institution founded in London.
1837. The office of Registrar-General appointed under the Poor-Law Administration.
1840. Compulsory vaccination ordained, and variolous inoculation made penal.
1855. Local Management Act passed; Board of Works formed, to effect a general system of sewerage.
1880. The last decennial period gives an increased mortality by small-pox.

THE CONSTITUTIONAL REQUIREMENTS FOR TROPICAL CLIMATES, WITH ESPECIAL REFERENCE TO TEMPERAMENTS.

By DEPUTY SURGEON-GENERAL MOORE, C.I.E.,
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(*Read: Jan. 14th*, 1885.)

During my Indian service I have habitually noted the effects of a tropical climate on Europeans, with special reference to their different temperaments and constitutions, and although I have not accumulated statistics in support of the views formed, I still venture to state them, by way of drawing attention to a subject which I consider important, although hitherto apparently somewhat neglected. Doubtless medical men, when consulted by a client on the propriety or otherwise of his proceeding to a tropical country, do take into consideration the person's peculiar temperament or constitution. But the matter is, so far as I recollect, ignored in books and by authors treating on tropical climates or diseases. Possibly the absence of figures in support of my views will not be regarded as any serious objection, for although arithmetic may be regarded as one of the exact sciences, incorrect deductions may be, and often are, drawn from figures.

Certain constitutional elements are common to all men, but they are not equally active, or developed in the same proportion in all persons. Thus we constantly speak of the effects of cold, of heat, of vitiated air, of alcohol, of tobacco, of opium, etc.; but different persons or constitutions are very variously susceptible to the influences of these agencies. The predisposition to particular ailments varies in a similar degree. In regard to some *contagia* especially, different persons and different family stocks show *original* differences of susceptibility. The severity with which small-pox, or diphtheria, or scarlet fever, will fall on one person as compared with another, and on one family stock as compared with another, is a sufficiently patent fact. Again, there seems to be a certain state of constitution which gives proclivity to such affections as carbuncle, boils, acne, and other surface maladies. I used the phrase "original differ-

ences of susceptibility" above, because such susceptibility is quite irrespective of those predisposing causes of disease which Carpenter states may be generalised under one expression, viz., "the accumulation of decomposing nitrogenous matter in the blood, either through its introduction from without, or from its excessive generation within the body."

In former times much more importance was attached to temperament than is now the case, as the blood phlegm and dual bile theory of Hippocrates testifies. It was indeed once an article of belief that certain temperaments qualified men for particular stations in life. Melancholic persons were supposed to be best qualified for kings, ministers, and councillors; choleric men were regarded as best fitted to be generals, foreign ambassadors, orators, and conductors of business requiring energy and despatch; sanguine men were suited for a courtier's life; but those who had the misfortune to be of the phlegmatic type, being supposed quite incompetent for any elevated position, were to be made labourers, and condemned to the lowest employments. Hoffman applied this doctrine of temperaments to nations, and thereby endeavoured to account for national peculiarities. Now, whatever may be thought at the present day of the blood phlegm and dual bile theory of Hippocrates, or of the deductions of Hoffman, there is, I submit, a morsel of truth in the metaphorical bushel of the last-mentioned author.

I am aware that Mr. Hutchinson, in his recently published work, *The Pedigree of Disease*, is not disposed to place reliance on temperament, regarding the different characteristics of temperament as rather indications of race, of youth and age, of health or disease and its effects, of past anxiety and trouble, or of freedom from them: and Mr. Hutchinson dwells on the difficulty of diagnosing temperaments in consequence of those traits of expression which have come through the wear and tear of life. Now, although the increased difficulty of diagnosing temperaments marked by such causes is undoubted, I do not think such difficulty presents in the cases of young persons, in whom the characteristics of temperament are usually as strongly marked as those of youth, and may be often as readily distinguished. And it is to the comparatively young that the remarks in this paper principally apply.

Temperaments are usually enumerated as four, viz., the sanguine, nervous, bilious, and lymphatic. Some older authors added to this number, by the addition of such terms as phlegmatic, choleric, melancholic, etc. On the other hand, some recent authors have omitted the third on the list—

bilious—as not required. For practical purposes, however, as connected with the suitability of different persons for tropical climates, I prefer to maintain the four types as enumerated above, for other types which have been named are really but variations from or exaggerations of these four. As these types should be kept steadily in view, it is desirable that the characteristics, as I hold them to be, should be briefly given.

The *sanguine* temperament is marked by ruddy and fair or bright complexion, fair hair, strong muscles, small head, large chest, and often, as age advances, plethoric habit. The thoughts are rapid, the imagination vivid, and the animal courage high; but there is frequently want of depth and persistence in the character. It may be said there is predominant sanguinification and activity of the vascular and muscular systems. A young man of this type has been likened to a high-bred horse; very active, capable of remarkable performances, but at the same time highly susceptible to surrounding influences. He is living at high tension, and a slight exposure to cold may induce an inflammation possibly of the lungs. There is, moreover, a general tendency to congestive affections, and diseases develop rapidly and frequently irregularly, and there is liability to active hæmorrhages.

The *nervous* temperament is marked by dark skin and hair, large head, spare muscles, and a generally thin and wiry habit. Frequently the chest is narrow and the circulation languid, with a preponderance of venous system. The movements are often hasty, with alternations of languor. Sensitiveness and irritability are marked in more than the average degree; but there is much energy, great mental powers, and capacity of intense thought, and also for the endurance of long fatigue, privation, and exposure. Maladies of the nervous system are common, while the organisation favours venous congestions, neuralgia, hepatic and intestinal obstructions. In extreme types of this class, there is probably predominant innervation instead of sanguinification, as in the sanguine type.

The *bilious* temperament, characterised by dark features, square build, and predominance of bone and muscle, is associated with the greatest endurance and the least sensibility to external impressions, and also to morbid disturbances. The name suggests a morbid habit or tendency in the liver. But the characteristics of this temperament may be and most usually are possessed without any extraordinary tendency to disease of the liver. The term *bilious* is a misnomer, and has arisen from the European of this temperament participating to some degree in the cutaneous excretion of carbon marking

the coloured races of mankind, and so assuming a more or less dark or so-called bilious aspect—an appearance, however, which is quite different in its origin from that consequent on liver derangement. The bilious temperament may be regarded as that in which there is still predominant innervation, although less so than in the nervous type, in which there is considerable sanguinification; although less than in the sanguine type, but greater than in the nervous; with consequent great muscular activity, and the peculiarity of the carbon deposit as above referred to. The bilious temperament may therefore be looked upon as the nervous temperament without its irritability, and as in some measure approaching the sanguine, without its high susceptibility to external impressions.

The *lymphatic* temperament is marked by more or less ungainly or ill-proportioned form of body, large joints, bulky head, awkward movements, light hair, tendency to flabbiness and fat, with languor of bodily functions. The disposition is ordinarily unexcitable, and, with probably good judgment, there is little energy. The powers of resisting disease are inferior, and there is tendency to disorders of the glandular system, to struma, to maladies of the liver and of the digestive organs. Both innervation and sanguinification are comparatively defective in this lymphatic type.

Whatever opinion may be held as to the origin of man, his surroundings of climate and food, and general circumstances of life, must be regarded as mainly instrumental in producing his modifications. In the orthodox view, as originating from a single pair, no other conclusion can be drawn. And in support of this conclusion it may be advanced that the differences of form and colour and temperament of the human race are certainly not more varied than their languages, which have taken thousands of years to assume their present form. As Max Müller remarks, "How much time was required before the Hindoos and Greeks, starting from the same centre, became so different in language as the Sanskrit of the *Veda* is from the Greek of Homer?" It is, however, probable that surrounding circumstances exert a greater effect on the evolution of temperament than even time. With the advance of civilisation temperament becomes more and more a race attribute.

When the Aryans descended from their northern homes, and, dividing into several streams, invaded new countries, there is reason to believe their complexions were white. The Aryan western offshoot, which afterwards became the Germanic stock, were certainly white, or they have since become

so. And we have the fact that the Eastern stream, the new comers into the north of India, several thousand years B.C., prided themselves on their fair complexions. Their earliest poets, 5,000 years ago, praised (in the *Rig Veda*) their bright gods, who subjected the black-skinned (meaning the aborigines of India) to the Aryan white; and their Sanskrit word for colour, "Varna," came to mean race or caste. But the influence of warm countries impresses certain peculiarities on the people who inhabit them, especially when, as in India (in former years to a much greater extent than at present), food and circumstances of life of all classes assimilate. It is notable that the inhabitants of Hindustan, whether aboriginal, with some exceptions, or unmixed Hindoos, or descendants of Arab or Mohammedan conquerors, do not evidence those variations of temperament characterising the Anglo-Saxon race. There is the dark complexion and skin, the dark hair, and the spare habit, associated with a quick intellect and irritable disposition, alternating with indolence and apathy, yet with great powers of endurance. The system is alternately easily excited or depressed, while the functions of the skin and liver are peculiarly active, and digestion often sluggish. Whatever may have been the characteristics of the Aryans, we now find one type and one temperament more or less pervading the whole of the inhabitants of Hindustan: a temperament which may be regarded as a compound of the nervous and bilious; partaking more of the latter type among the higher classes and more approaching the former type among the lower classes. There is rarely found the variations which the European presents; the difference, for instance, which exists between the typical nervous, excitable Frenchman, and the dull, heavy, phlegmatic Dutchman.

The following appear to have been the principal causes operating in this conversion of type. Exposure to the heat of a tropical climate and the force of a tropical sun, which, if the person keeps healthy, tends to bronze the white skin—to convert it, in fact, into an approach to the bilious aspect of temperament—although blanching the European, if, unhappily, he becomes the subject of that slow blight of the constitutional powers occurring from tropical climatic influences, and chiefly manifested by a diminution in the red corpuscles of the blood. *Secondly*, the habit, which would be quickly acquired, of passing much of the day—as the natives of India even now do—wearing the minimum of clothing, an exposure which must tend directly to darken the skin. *Thirdly*, residence on a soil from which the necessaries of life were produced with a minor degree of labour, which, in several distinct

manners, would lead to retention of carbon in the blood and its deposit in the tissues. For there would be, as a consequence of little labour, a minimum of respiratory movement, and therefore a minimum of inspired oxygen; there would be an atmosphere rarified by heat, and consequently containing less oxygen in a given bulk, and therefore in a given number of respirations; and there would also be a too carbonaceous diet. For although the Hindoos are now chiefly vegetarians, it is almost certain they were not so when they first descended from their frigid northern homes into India. Dwellers in colder northern climates consume, as is sufficiently well known, large quantities of animal food, and several allusions in the *Vedas* indicate that the Aryans were neither vegetarians nor total abstainers; for the flesh of the wild cattle is allowed by one passage, and in another the flesh of the cow is praised as the best of food. As regards drink, the gods, and especially Indra, are frequently conjured to imbibe the earthly drink, the juice of "the sweet, exhilarating, celestial, fruit-yielding soma." It has been supposed that the Hindoos adopted a vegetable diet under the influence of their Brahminical leaders, in order that their scanty northern breed of flocks and herds might increase and multiply in the fertile plains, the kine being especially useful as beasts of burden and for agricultural purposes. But it is also probable that a vegetable diet was dictated as a desideratum of the climate; perhaps, even, as a means of checking the tendency to a dark skin. The Brahmins who wrote the *Vedas* must have been intellectually capable of appreciating the evil effects of too much animal food in a tropical climate, although they may not have reasoned the matter out by the light of the nineteenth-century science. Not one, but the several causes named above, probably led to the Brahminical law prohibiting the use of animal food, and rendering kine sacred. *Fourthly*, the conquest of, and resulting partial amalgamation with the darker aboriginal tribes. When we recollect that in one or two generations, Celts and Saxons, Teutons and Danes, *cum multis aliis*, are converted into the sallow, typical, inevitable Yankee, the conversion during thousands of years of the light Aryan into the dark Hindoo appears facile.

Now, theoretically, it would seem that the European, who in type and temperament most closely resembles the condition to which climate and mode of life has converted the native of India, would be best fitted to encounter the adverse influences of a tropical climate; and practically this appears the case. I have usually noticed that the European marked

by the characteristics of the *bilious* temperament, or, still better, of a *bilio-nervous* temperament, have ordinarily enjoyed the best health in India. Sir Joseph Fayrer says, "Vigorous, healthy persons, of moderately spare frame, with sound viscera and temperate habits, can withstand a great amount of heat"; and persons answering to the above description are usually of the temperaments named. But there must be no predominance of the nervous temperament, which was regarded so far back as the days of Sydenham to be the basis of hysteria and hypochondriasis. A highly sensitive and sympathetic nature is not most conducive to health and happiness, when submitted to the daily or even hourly ills and irritations inseparable from life in the tropics. It is not given to men of nervous temperament to possess the philosophical phlegm of a Socrates, who, when Xantippe wound up one of her little speeches with a bucket of water over her husband, could calmly observe, "After thunder rain generally falls." If, fortunately, there are no domestic causes of depression, arising, as so frequently the case, from sickness and separations, there are still minor evils, as the humming and stings of musquitoes, the buzzing and tickling of flies, the fluttering and chirping of sparrows, the cawing of crows, the itching of prickly heat, the frequently irritating conduct of native employés, etc., which, regarded in themselves as petty annoyances, are by their very perpetuity as the dripping of water, and rarely fail to make an impression. In short, the hundred and one annoyances confronting the European in the East are exceedingly trying to the typical nervous temperament, especially when, after a time, novelty wears off, and the system becomes enfeebled by the effects of continued heat. Then, like a metaphorical shirt of Nessus, the minor ills of every-day tropical life appear to act as a continued blister over the whole moral epidermis of the nervous temperament. A French physiologist is credited with saying, that if you want long life you must possess a bad heart and a good stomach. Without endorsing this assertion, it may with certainty be stated that a highly nervous organisation, especially if, as often the case, associated with feeble digestion, is not fitted for prolonged tropical residence. I might support the foregoing by reference to various Anglo-Indians of celebrity, while I scarcely call to mind any who have not in type and temperament more or less approached the standard as above.

But, curiously enough, the temperament which seems next best suited to the tropics is the reverse, or the sanguine type. This, perhaps, may be explained by a temporary less liability

to anæmia; by the high animal courage, and the tendency to look on the best side of matters marking the type. But the sanguine are far more apt to suffer from head affections; and as Mackinnon long since remarked, "those of fair complexion and light fibre are most liable to hepatic abscess". Moreover, as previously mentioned, the great susceptibility to external impressions (except for a time those causing anæmia) renders persons of this habit and disposition less qualified to cope for an indefinite period with the daily annoyances of tropical life. The sanguine temperament endures only for a period, and may rapidly or suddenly give way. It is, however, according to my observation, noteworthy that the longer persons of sanguine temperament live in India the more decided is the change towards the bilious variety. And this is probably to be explained by a consideration of the general effect of a tropical climate on the European.

Even in a temperate climate a long-continued warmth checks vital action, and produces a degree of depression; conditions which in the tropics are more general and apparent. Sir J. Fayrer has recently observed, "Heat is so closely associated with other conditions, such as electric, hygrometric, and barometric states of the atmosphere, telluric and other miasmatæ, that it would be difficult to say how far heat alone is concerned in affecting health." But I think we can trace a certain deterioration to the influence of heat. There is reason for believing that increased climatic heat raises the temperature of the body in those recently arrived in the tropics. Sometimes a slight degree of continued febrile excitement is distinguishable, which may be called "masked thermic fever"; and we know that fever cannot progress without some blood deterioration. Brunton has shown that by keeping an animal in a hot chamber the tissues decompose more readily, and evidence of their waste is found in an increase of urea. And so it is with the European transferred to the tropics, whose urine is lessened while urea is increased. Then we have the influence already mentioned as instrumental in the conversion of the ancient Aryan into the present Hindoo, viz., a minimum of exercise, entailing lessened respirations, and consequently a minimum of inspired oxygen; air rarified by heat, and therefore affording less oxygen in a given number of respirations; an expanded and consequently less elastic air, and therefore less fitted to dilate the chest. And although the diminution of inspired oxygen may be slight, it must be recollected that it is continuous. It is perhaps, however, sufficient in some degree to explain

the characteristic diminution of red particles, for there is reason to believe that with less oxygen there is less demand for the carriers of oxygen. With all this we have a too rich diet in which Anglo-Indians indulge. The conditions lead to less determination of blood towards the chest, to lessened sanguinification, to accumulation of blood in the umbilical region and vena potarum, to at first, perhaps, an augmented secretion of bile, but afterwards, as hepatic congestion merges into hepatic deposit, to the reverse. The anæmia thus produced starts, therefore, from a disturbance of sanguinification which leads to enfeeblement of the digestive powers, which still further disturbs sanguinification, and so a vicious circle is established. With the dyspepsia the nervous system is depressed, with loss of flesh and sallowness, or there may be disposition to accumulation of fat; for, as Brunton has shown, when the power to convey oxygen is lessened by the diminution of the red particles of the blood, the consequent want of oxidation leads to the accumulation of fat. We have, therefore, as the result of heat—or if you prefer it, as the result of hot climate—a raising of the bodily temperature; a degree of thermic fever; an increase of urea; a diminished action of the lungs; an impairment of digestion; a nervous depression; a derangement of hepatic function. All these changes are compatible with fair health: or at least may be so slight as to remain long uncared for. But most of them seem calculated, by leading to the detention of carbonaceous matter in the blood, to produce alteration of temperament towards the bilious variety.

It is not to be supposed that the question of temperament will, in these days of an ill-advised short service system, be considered sufficiently important to regulate the choice of soldiers for tropical duty. For, as a rule, notwithstanding the recognised liability of young soldiers to typhoid (or rather perhaps to climatic fever resembling typhoid), the European usually enjoys the best health, and feels the heat least oppressive, during his first years of tropical life, or before that blood deterioration progresses, which so characteristically impresses on the appearance of the European the combined stamp of heat, of so-called malaria, of a rarified air, necessitating a diminution of oxygen, and probably of the want of a due proportion of vegetable food,—a deterioration which, under agencies I will not stop to name, occurs more quickly among soldiers than to other classes. I think, however, the sickness and mortality, not only of soldiers, but also of Europeans generally in India, would be materially lessened if the question of temperament were taken into

prominent consideration when deciding on fitness for the tropics,—not as the main determining factor, but as one turning the balance in cases of doubt. For it must not be forgotten that in addition to the greater liability of some temperaments to be affected by the influences attending tropical life than others, different temperaments are ordinarily associated with a constitutional condition or *diathesis*, rendering persons of different type more prone than others in any climate to certain specific diseases. The term diathesis may be defined as any condition of health giving rise to proclivity to definite forms of disease, and therefore it must not be forgotten that a diathesis may be acquired, as for example the syphilitic, the malarious, the scorbutic, all of which should forbid tropical residence.

Similarly, with regard to return to India, the question of the propriety of which arises sooner or later to the great majority of the many who leave the East for the recovery of health. Duty, business, pecuniary matters, promotion, etc., frequently induce individuals to return to India before they are thoroughly recovered. Then the medical adviser may be called upon to decide between the probable results of an existing tendency to disease, and the injurious effects of mental depression and anxiety which most must feel when emergent business or duty impels in one direction, and health in the other. In such cases the choice must be one of two evils. The person with the temperament best fitted for the tropics may be allowed to return, if urgently necessary, at an earlier period of convalescence than the person of opposite constitution.

Hereditary predisposition to disease must also be entitled to consideration, oftentimes irrespective of temperament; and that peculiarity of hereditary predisposition termed *atavism*, in which a morbid tendency disappears in one generation to reappear in another, should not be forgotten. Unfortunately, many people attempt to hide family weaknesses, and the medical man may be obliged to form a judgment from answers to indirect questions. Scrofula, consumption, gout, epilepsy, insanity, cancer, asthma, certain urinary disorders, hæmophilia, or the hæmorrhagic diathesis, are among the most important hereditary transmitted maladies. An hereditary tendency to gout, epilepsy, insanity, asthma, certain urinary disorders, or to the hœmorrhagic diathesis, should, I think, debar a tropical career. Gout, I believe, will be developed sooner and in a more irregular manner in those predisposed, if residing in a tropical climate. Among the sum of the operations of the various conditions of climate

and place, which we are accustomed to call malaria, one of the principal causes of blood deterioration in the East is the scorbutic taint, and which, I believe, may be *latent* in the system, existing without showing itself by any of the manifestations, such as swollen gums and effusions, which we are accustomed to associate with scurvy. I will not stop to show the excessive prevalence of scurvy in the East, further than to mention that Deputy Surgeon-General Hewlett, Sanitary Commissioner, Bombay, in a quite recent special report on enteric fever in the Bombay Presidency, has remarked on the great prevalence of the scorbutic taint in the European army, and regarded by some medical officers as due to malarious cachexia. As regards natives, I myself, in a paper entitled "On some Points connected with Scurvy," brought before the Bombay Medical and Physical Society in 1882, and published in the Society's transactions for that year, as I think sufficiently demonstrated the general underlying scorbutic condition of the natives of Western India, whether in military or civil life. I think the prevalence of scurvy taint in the East will not be questioned, and such being admitted, I have the authority of various authors, from Sydenham in 1680, to Ralfe in 1882, that there is not only a close resemblance between gout, rheumatism, and scurvy during the earlier stages of the disease, but also a close pathological relationship. Thus Sydenham wrote:—"Where matter suited to produce gout is newly generated, there appear various symptoms which occasion us to suspect the scurvy, till the formation and actual appearance of the gout remove all doubt regarding the distemper." And Ralfe writes—"The premonitory symptoms of scurvy closely resemble those that generally precede an attack of gout; there are the same fugitive and erratic pains in the limbs, tenderness of the joints, etc." As regards the pathological relationship, scurvy is induced by diminished alkalinity of the blood, owing to the withdrawal of alkaline bases supplied by vegetable food. In gout there is diminished alkalinity induced by positive addition and accumulation of acid salts in the blood. In rheumatism there is abundant development of acid, local rather than general, and excited by catarrhal influences or *chill*, interfering with the normal passage of acid from the system *viâ* the skin. I therefore submit that, *as a consequence of the prevalent scorbutic taint*, there is a special tendency to the development and the irregularity of gout in India. Similar remarks also apply to rheumatism. As regards scurvy itself, if there is one factor among the number which predispose to scurvy more powerful than

another, it is a previous attack of the malady, which should be regarded as sufficient to deter from tropical residence.

Epilepsy may be excited by the effects of heat, or as the result of the blood deterioration above referred to. Insanity of various kinds is brought on in the same manner. Some persons have what may be called the insane temperament: a certain *neurosis* or diathesis, easily prone to disturbance. They feel impressions in a way other people do not, and are disposed to sudden and whimsical influences, a disposition which is enhanced by the heat and irritation of tropical life. Sir Joseph Fayrer, detailing a case of "melancholia, despondency, and delusions following malarial fever", remarks, "It is probable there may have been some hereditary tendency to these conditions, and it is just this which would be intensified and developed into a morbid state, with a liability to periodic recurrence, by malarial poisoning." Malarial asthma, described by our respected President, is a well-recognised complaint, the asthmatic tendency being intensified and developed in similar manner. As regards the hæmorrhagic diathesis, bleeding from the nose and gums are perhaps the most ordinary manifestations. The former (bleeding from the nose) is often a sequence of malarious cachexia; the latter (bleeding from the gums) is an ordinary result of the scorbutic condition. It is therefore evident how the hæmorrhagic diathesis is likely to become developed by tropical life. On the other hand, it does not appear that any hereditary tendency to *scrofula*, *consumption*, or *cancer* is developed by a tropical climate. On the contrary, hereditary tendency of the two former maladies has seemed to be kept in abeyance; for within my knowledge, brothers and sisters who have remained at home have suffered, while those who have gone to the tropics have remained free. *Cancer* being usually an affection of later life, is rare among Europeans in India, who are considered unfit for tropical service after fifty-five, at which age, in Europe, many men are in their full intellectual prime.

Before leaving this part of the subject, I mention that I think there is also an hereditary tendency to ague, and to so-called malarious degeneration generally. I believe, from observation and inquiry, that the offspring of persons (to use a common expression) saturated by malaria, are more liable than others to so-called malarious degeneration; and I think that the question whether an individual's parents suffered from malarious disease previous to the birth of the individual, should be held in view as affording an additional make-weight in the decision on a doubtful case.

There is another malady which, although not regarded as hereditary, is yet a disease which should prohibit tropical residence. I allude to *albuminuria.* Albuminous urine may be excited by the congestion taking place in the kidneys, in common with all abdominal organs, during paroxysmal fever. And this may be either temporary, passing away in a few days or weeks; or the chronic form, terminating in deposition, attended perhaps with absorption of renal tissue. The latter may also arise as a result of the condition we are accustomed to speak of as chronic malarial cachexia, without the additional exciting cause of prior fever paroxysms. Thus, in India, we have other predisposing influences in the presence of what we are accustomed to term malaria, added to those fertile causes of one or other form of albuminuria, to which the inhabitants in large towns in England are subjected. If the urine passed during or soon after a febrile paroxysm is examined it will frequently show albumen. When ague becomes habitual, albumen is more constantly present. When there is tendency to the scrofulous diathesis, and a constitution deteriorated by malarious influences, the renal condition may be confidently foretold. If in Europe a person has suffered from albuminous urine, the recurrence of the renal affection under the influences we call malarious is most probable. I mention this with emphasis, because it is opposed to ideas entertained, or at least entertained some years back. The question whether a person, once the subject of albuminuria, should or should not proceed to India, has, I have reason to know, been decided in the affirmative by eminent physicians. Experience has, however, convinced me that semi-tropical, tropical, and so-called malarious countries, should be prohibited to all who have passed albumen—unless an accidental occurrence depending on temporary cold or dietary errors. If the kidneys have once been subjected to the slightest degree of degeneration, the danger of confirmed albuminuria resulting from paroxysmal fever is great. The idea once prevalent in England, that albuminuria is not a malady of hot climates, is erroneous.

Idiosyncrasy, which Mr. Hutchinson regards as "individuality gone mad", should also be studied. The irritation which those of highly nervous temperaments must suffer in Eastern life has been already referred to. But people whose peculiar idiosyncrasy is frequently offended may be even worse situated. As we all know, there are people who are violently affected through any of the senses. The poet, when speaking of those who "die of a rose in aromatic pain", was not altogether depending on his licence, for the odour of a

rose has been known to excite fainting. Habit or idiosyncrasy will enable some people to consume large quantities of opium or arsenic. The smallest dose of mercury will salivate some persons: a few grains of iodide of potassium may induce coryza; assafœtida sometimes produces faintness; there are people who cannot go into a room where there is ipecacuanha, or a cat, without sneezing; others cannot eat celery without suffering from nettlerash; and what is of still more importance, there are some few who cannot take even half a grain of quinine without suffering from catarrh or urticaria to such an extent as practically to forbid the use of this agent. As almost everyone, at some time or other of a tropical career, will require to take quinine, I think an inability to do so should be regarded as a reason why tropical life should be avoided: for although Indian practice shows that quinine is not quite the panacea which text-books would make it, it is nevertheless a most essential part of our armament. The deadly fear of snakes may be instanced as another example of peculiar idiosyncrasy. However ridiculous it may appear to our esteemed members, Sir Joseph Fayrer and Dr. Ewart, who are accustomed to manipulate snakes with the freedom of a culinary *artiste* employed on eels, there are persons who have a more deadly horror of Indian snakes than they have of that old serpent of all! Those thus disposed had better keep away from snake-land, for it is extremely probable that during their sojourn in India they will suddenly confront a snake,—a meeting which has ere now been followed by fatal syncope, not from the injury received, but from fright. Again, intense fear of disease should disqualify for the tropics. When epidemics, as cholera, "rush as a storm and strew with sudden carcases the land", fear most certainly not only prepares victims for the reception of the poison, but also prevents recovery when the poison acts. Persons in India who thus dread disease live the life of a modern Damocles. They see danger everywhere, and, like Voltaire, regard the atmosphere as "a blue and white mass of noxious exhalations".

There is a peculiarity noticed as sometimes associated with the sanguine temperament, in the shape of habitual, copious, and rapid evolution of heat on the surface of the body, especially about the neck and face, leading the person to seek the coolest place even in winter. It is stated that a gentleman thus troubled found the top of Arthur's Seat a refreshingly cool place on a bleak winter's morning. When this peculiarity exists, the individual is not well suited for tropical life, and will in a hot climate suffer from heat to a compara-

tively much greater extent than others. He will perspire, and require the continual application of a handkerchief to the neck and face, when others of different habit are cool and calm. It is mentioned that this peculiar evolution of heat has sometimes been found apparently with præcordial surface vascularity, in the form of small varicose vessels situated on the front of the thorax below the left nipple.

Age is, of course, a matter of importance as regards Indian life. It is not desirable that very young persons should go to India. Section 18, para. 14, of the *Queen's Regulations for the Army*, lays down that no man is to be sent to the tropics until he has been thoroughly drilled, also that the age should not be less than twenty. But, as a matter of fact, many men are sent before they are twenty. I well recollect having, but a few years back, been obliged to weed out in Bombay a large number of young soldiers from a regiment sent to India during the month of September, for immediate service in Afghanistan—young soldiers who were unable to bear the passage down the Red Sea, which had utterly unfitted them for the toils of an Afghan campaign. Deputy Surgeon-General Hewlett, Sanitary Commissioner, Bombay, in a recent special report on enteric fever in that Presidency, recommends that men should not be allowed to land in the country until they have attained the age of twenty-five years; and the Army Sanitary Commission gave similar advice some time back. The experience of the French in Algeria may also be quoted as confirmatory that only fully formed men should be sent to tropical countries. If it could be so arranged, it would certainly be well if no European went there until at least twenty-one years of age. But as even this, both in civil and military life, seems, for many reasons (which need not be specially referred to), impracticable, it is merely stated that the nearer this age is approached the better will the individual bear the climate, and probably the more care will he take of himself. Notwithstanding that some writers have portrayed the Indian climate as even favourable for European children, the fact remains that they grow up weak and weedy, deficient in energy and deficient in strength. Therefore it is not desirable that the climate should be braved before the process of growth has matured.

Although some men are as young, physically and mentally, at sixty as others at fifty, it is nevertheless the rule that between those ages a good deal of the elasticity and pleasure of life naturally departs. A man of fifty-five is far on the road towards the last act of the farce. He seldom feels so well as he did at twenty-five. He takes more interest

in rheumatism, and has more awe of bronchitis; he is not ardently hopeful, and he has probably discovered that this is a world in which merit is often overlooked. He shows signs of loss of power, diminished sensibility, impaired memory, muscular weakness, etc.; while such maladies as calculous affections, osseous deposits, or organic visceral disease are more likely to develop. As previously mentioned, fifty-five is the age fixed by regulation at which Anglo-Indians are required to vacate executive offices in the public services. In the majority of instances the period is too early, most men being then, even in India, still able to do good service, and not yet disposed to regard the future as a thing entirely belonging to their sons. For it must be recollected that such men represent the "survival of the fittest"; men who, like good wine, have mellowed by age; men who have supported the burden of the days under which so many of their compeers succumbed, and who therefore may be credited with more than the average *vis vitæ*, with prudence of life, with the suitable temperament, and with freedom from disease.

With regard to age, it may be mentioned that a tropical climate is not favourable to longevity, even of the natives of the country. Dr. Maconachie, Ophthalmic Surgeon, Bombay, has recently stated that cataract—an acknowledged symptom of senility—occurs at a much earlier age among natives than among Europeans; and it has been proved that the average number living at each age-period in 10,000 of each sex is, after fifty years of age, altogether in favour of England as compared with the Bombay Presidency, to the extent of about two per cent.

It will rarely happen that medical men will be consulted regarding the propriety of men past the tenth lustrum proceeding to India. This may, however, occur with reference to higher State appointments, or in the case of private gentlemen. In such instances, while apparent good general health is a *sine qua non*, freedom from incipient visceral or cardiac disease, and from gout, should be ascertained. Then much will depend on the time of year, and more on the part of India in which the individual has to reside. If he has to go out in the hot season, and to remain altogether in the plains, my advice would certainly be not to go. If he can reside during the hot season on the hills, he might proceed with safety. And this leads to the *questio vexata* of residence on the hills of Indian officials during a considerable part of the year. It is objected that such procedure isolates officials from the people and from public opinion, and thus tends to maintain

the still wide breach between Europeans and natives. The advantages, however, of residence on the hills, not only to individuals but also to the State, far counterbalance any objections which have been advanced. As a general rule, during the hot weather of the plains of India, the Briton is not himself. The Indian climate throws its net over him, and, struggle as he may, he must yield to its pressure. Nature seems then in conspiracy to dull energy, weary the brain, and weaken the body. It is only by a periodical escape from the influence of the plains that the majority of Europeans can maintain both mental and physical health and vigour, and it is of the greatest importance that the high officers of State should maintain this mental and physical vigour. For while sickness is sufficiently lamentable in the case of the lowest official, still the results are confined to his own household, or at least to his own immediate, and necessarily more limited and less important, circle. But when a great officer of State is *hors de combat*, the results permeate to the confines of the Empire, public business is delayed, and many people are affected in exact ratio with the exaltation of the position of the ailing man. Moreover, residence in the hills may be regarded not only as exciting a sanitary effect on the body, but also on the mind. Work is better done, and more of it; notwithstanding that carpers have termed Simla the "Capua of India". There is also another advantage. It was mentioned above that the question of a man of advanced age proceeding to India would only arise in the case of high officials. Men eminent in their particular line have been, and doubtless will be again, sent out to India at a comparatively advanced age. Governors-General, Governors of Presidencies, judicial officials, are usually not very young men. The capability of passing part of the most trying season of the year in the hill climates renders such men able to accept office. If it were not for such capability, they would only accept office at such risk to health as would be practically prohibitive, and their services would be lost to the State.

Sex is a very important element in forming the statistics of sickness and mortality among Europeans in India. The functions of menstruation, parturition, and lactation exercise in all countries a powerful influence on female health, and this influence is most marked in the tropics. It must be recollected that there are in the female system additional and important organs, specially subject to tropical influences, and, therefore, there are additional reasons why European women in the tropics should, as they so often do, break down sooner

than men. Many causes combine in inducing a greater tendency to womb and ovarian disease in the European female in India. The excitement, novelty, and fatigue consequent on a journey to the tropics, perhaps before the periodic functions have been thoroughly established, is often a first factor. Sea-sickness may also occur, the action of vomiting being sufficient in some constitutions to retard, or to hasten, or to increase the periodic flux. Then one of the first effects of a hot climate is a greater tendency to affections of the abdominal viscera, in which condition the womb and its appendages partake. Sir Joseph Fayrer and Dr. Ewart remark of European females in India: "The greater confinement to the house, often in darkened rooms, and their sedentary lives, tend to induce laxity of fibre, impairment of digestion and assimilation, and anæmia; and result in a few years in premature ageing, attended by recession of the eyes, prominence of the cheeks, and a certain amount of pinching of features and loss of flesh." But I believe the degeneration described by Sir J. Fayrer and Dr. Ewart may occur simply as the result of heat, as indeed it does occur in soldiers' wives, for instance, who do *not* confine themselves to the house; who do *not* live in darkened rooms; who do *not* lead sedentary lives, to nearly the same extent as the upper classes. Clarke long since observed: "Females suffer many circumstances of ill-health peculiar to the sex, from mere heat of climate and relaxation of tissue." And I think there is, as a result of heat, a direct relaxation of the tissues more decided in the female than the male. Superadded to the causes of ill-health enumerated, there is often exposure during the menstrual period, and neglect of suitable clothing; for it is too frequently believed impossible to take cold in so hot a climate. Then there are errors of diet, leading to intestinal irritation, chills from tatties, punkahs, or thermantidotes, too violent and spasmodic exercise at the fashionable lawn-tennis, or on horseback, the lassitude produced by heat and the consequent neglect of sufficient moderate exercise; also, probably, late hours and a plethora of male society. Even if the individual escapes injury from the influences enumerated, she, probably, bears children too quickly, or she miscarries, and she suffers from intermittent fever, or from the fever described by Dr. Chevers as "malarious *post-partum* fevers". Why the female should be more subject to periodic or malarious fevers before or after parturition, has been theorised to depend on the womb being an organ subject to regular periodical influences, and, therefore, most likely to be "impressed with malaria". Whether this is correct or not, there is no doubt of the fact

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that the womb is especially liable to be affected by those climatic influences we speak of as malaria. The womb, thus irritated and weakened, lying in the immediate neighbourhood of the large bowel, tends directly to the excitation of diarrhœa, or dysentery, or hæmorrhoids; while, on the other hand, the occurrence of either of these ailments tends to aggravate any womb-affection present, and to induce it if absent. The greater inability of European females to nurse in India also helps to explain the frequency of uterine affection, for suckling promotes the subsidence of the organ to a normal condition after pregnancy, and therefore renders it less liable to be influenced by some of the causes referred to. If it is desirable, for reasons previously stated, that people should not proceed to the tropics before the growth of the body is matured, it is doubly important that females should not so proceed until not only the growth of the body is matured, but also not until the functions of menstruation are regularly and healthily performed. Moreover, those who have suffered from any decided menstrual disorder may be advised to remain in a temperate climate. The same advice applies to almost any uterine affection, to that extensive class of maladies women delight in terming "internal complaints"; for it may be stated as an axiom that uterine affections will progress from bad to worse in India, the uterine malady itself rendering the individual more susceptible to climatic influences. Thus, not only should known uterine malady debar tropical residence, but females of chlorotic, anæmic, sallow appearance should be regarded with suspicion, when applicants for advice regarding suitability for tropical climates.

Before concluding these remarks, I desire to say that although there are certain constitutions more or less unfitted for the tropics, and although there are certain conditions which should prohibit residence in the tropics, still the diseases incidental to the climate may be often escaped, or at least modified in severity, by attention to ordinary general sanitary principles, and to personal hygiene. Much is often attributed to climate which is really the result of want of care, or even indeed of the want of ordinary precaution. If Anglo-Indians will not for themselves "study well the clime and mould its manners to their obsequious forms", they should, for their own advantages, take the advice which in several books has been so plainly placed before them. But this is just what the majority, in the pride of a fleeting youth, and passing health and strength, do not do. They appear to think "all men mortal but themselves", and they suffer in

consequence. Men and women, especially young men and women, as a rule, utterly ignore that most prolific cause of disease—*chill*; and cannot understand, or at least do not act as if they understood, that a sudden reduction of the temperature of the body in India is as fraught with evil consequences —will indeed produce even a greater impression, than a similar reduction in England; the very heat itself in India rendering the skin more acutely sensitive to such impressions. Similarly, they ignore the sun, although at every turn they see the natives of the country protecting themselves with *turban* and *cummerbund*, and seizing every opportunity to place some kind of shade between themselves and the rays of the great luminary. Although they have probably read the classics, in which there are half-a-dozen stories showing there are wishes the gratification of which is fatal, they do not profit thereby. They do not hesitate to gratify their desires to the extreme; eating more animal food than is necessary; drinking more fermented liquor than they would probably do in a temperate climate; and sleeping away the drowsy after-"tiffen" hours, than which few habits are more deleterious. Then there is want of care about water, about personal sanitary arrangements, the indulgence in violent spasmodic exertion, to the neglect of daily moderate exercise, and oftentimes (especially with women) too much horse exercise. Then there is idleness, about which Dr. Watts would probably have rhymed still more forcibly had he observed the mischievous results thereof in the tropics. Most persons in India have a sufficiency of leisure time, and that leisure should be employed. Even a comparatively trifling *spécialité*—as the study of beetles or sea shells, for instance—is far more conducive to health than idleness. There is considerable force in the remark of the busy official, who explained his continuous good health by saying he never had any time to be sick.

In conclusion, I must ask pardon for anything in this paper trite and familiar to the members of the Epidemiological Society. But I submit that we could scarcely carry on without a little blindness to the fact that most things have been said better than we can say them ourselves. Supposed originality is but too often unconscious imitation. Byron years ago remarked that pretensions to originality are ridiculous, and an older author than Byron has told us "there is nothing new under the sun".

ON THE PREVALENCE OF EPIDEMIC ROSEOLA IN CALCUTTA.

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(*Read: Feb. 11th*, 1885.)

During the hot weather and rains of 1881 my attention was attracted by a series of cases of an eruptive fever, which occurred in my private practice, and which presented phenomena different from any which I had previously observed in any exanthem either at home or abroad. I held, at the time, the office of Health Officer of Calcutta, and, desirous to ascertain whether other medical men had met with a similar disease, I circulated among the principal practitioners of the town a series of questions, designed to elicit their experience. I received nineteen replies to my circular: thirteen of the nineteen gentlemen who favoured me with information had seen cases of fever associated with a skin eruption. One had met with fifty cases, one with twenty, and the remainder with smaller numbers, varying from six to twelve. I threw the notes which I had myself made, and the observations which had been communicated to me, into the shape of a paper, which I read at the September meeting of the Calcutta Medical Society. This paper formed the basis of several discussions, and both the paper and discussions were published in the *Indian Medical Gazette*. Cases of a similar kind continued to present themselves during the cold weather of 1881-1882, and in the month of February of the latter year, I again drew the attention of the Calcutta Medical Society to the subject, and succeeded in extracting a few additional observations from its members. These have also been printed in the *Indian Medical Gazette* (for March 1882). The facts obtained and recorded in this manner constitute the basis of the observations which I venture to lay before the Epidemiological Society this evening. The data are somewhat fragmentary and not very precise; but such as they are, they appear to me to establish the occasional appearance in Calcutta of an exanthematous disease different from those usually met with in practice, the phenomena of which re-

semble in many respects those appertaining to the disease known and described as Rubeola, Rubella, Epidemic Roseola, or Rötheln.

In describing an epidemic exanthem, it is usual to consider its symptoms and manner of prevalence or epidemiology. The most important points connected with symptomatology are—(1) the period of incubation; (2) the period of invasion; (3) the skin eruption; (4) the pyrexia; (5) the complications; (6) the sequelæ; and (7) the mortality. Under the head of Epidemiology the principal questions relate to (1) the circumstances of prevalence—local, seasonal, and hygienic; (2) the class of persons affected, particularly as regards age and sex; (3) the causation and communicability of the disease: (4) its self-protectiveness; and (5) its relations to other exanthemata.

I shall dispose the material which I have collected under these heads, with a view to orderly arrangement, and for the purpose of facilitating identification.

1. As regards the period of incubation I possess no data.

2. The phenomena of invasion resembled those of other exanthemata—malaise, chilliness, anorexia, etc., succeeded by a somewhat sudden elevation of temperature. In all cases there was a distinct pre-eruptive disturbance of health, and in many instances severe muscular pains were observed at this time, suggesting a suspicion of dengue. Vomiting was not specially noticed, and swollen watery eyes, running at the nose, and sneezing were either inconspicuous or absent.

3. The eruption generally appeared on the second day, sometimes on the third — that is to say, twenty-four to thirty-six hours after the onset of fever and other symptoms of disturbed health. In some cases its appearance was delayed, but these were exceptional. The exanthem usually affected the face, trunk, and limbs successively, but this order was not invariable. The rash lasted for two or three days, and was not succeeded by desquamation. In some cases a shedding of a few branny scales was noted. Some reporters described the rash as being of an erratic and evanescent description. In its physical appearances the eruption resembled that of measles, rather than of scarlatina, but it was easily distinguishable from both. It was papular in character, and the papules were slightly raised, evidencing exudation as well as congestion. The papules occurred in spots and patches of a circular shape, spreading by a circular margin, becoming confluent and diffuse in some cases. These spots and patches were of a bright rosy red, or crimson colour, neither livid nor purple, and they never presented any semblance of a crescentic disposition.

4. The pyrexia was in most cases severe. It set in one or two days before the appearance of the rash. The maximum temperature varied in different cases from 100 deg. to 105 deg., and the evening temperature was generally about 1 deg. higher than the morning. As the eruption faded the fever declined, and if no complication existed, recovery took place after an illness of about a week. The pyrexia was accompanied by the usual symptoms, thirst, restlessness, furred tongue, scanty urine, etc. In some cases delirium was observed, and occasionally much prostration and drowsiness existed, the bowels were usually constipated, and diarrhœa was the exception. The pyrexia subsided by lysis rather than by crisis.

5. The complications observed were various, but those most frequently noted were tonsillitis and bronchial catarrh. Injection of the conjunctivæ and watery eyes were present in some cases, but this was by no means an invariable symptom. Some degree of coryza and frontal headache were also noticed; but these features were not so prominent as in measles. The fauces were congested and tonsils enlarged in most cases. The faucial angina was severe in some instances, and towards the close of the epidemic in the cold months the throat symptoms were more urgent and distressing. In a few cases an attack of acute tonsillitis preceded the appearance of the eruption. An aphthous pellicle formed on the surface of the tonsils sometimes, and in one instance in my own practice diphtheria ensued after the subsidence of the eruption. Slight enlargement of the lymphatic glands of the neck was noticed by one practitioner. This is considered to be an important sign of rötheln as contrasted with measles and scarlet fever, and I regret that I did not make particular search for it in the earlier cases that came under my own observation. Towards the close of the epidemic, when the throat symptoms were more severe, I observed that the "lymphatic glands of the neck became tender and swollen". The tongue was generally thickly coated, and in many cases, more especially towards the close of the epidemic, the papillæ at the point and sides of the organ were enlarged and turgid, projecting through the fur as minute bright red points. The coating gradually disappeared as recovery progressed, and did not peel off, leaving a raw abraded surface as in scarlatina. Bronchial catarrh was the most common complication, and one practitioner met with catarrhal pneumonia in a few cases. The bronchial irritation was by no means invariable, and it generally disappeared with the subsidence of the fever and fading of the eruption. Intestinal compli-

cations were rare. Diarrhœa was observed in a few instances, and dysentery in one case. The urine was generally found to be scanty and high coloured during the height of the disease; but in those cases in which a chemical examination of the secretion was made, no albumen was found, nor were any indications of œdema or anasarca observed either during or after the disease.

6. Sequelæ were conspicuous by their absence. In one case diphtheria followed the disease, as I have already mentioned; but this was quite exceptional, and both the pulmonary and glandular affections, so common after measles, and the renal and arthritic troubles so apt to succeed scarlatina, were happily absent.

7. The mortality was very trifling. A few fatal cases were met with. One was reported by Baboo Jagendra Nath Ghose —"an aged person, in whom the eruptions were quite unlike any of the exanthems, being red, flattened, raised patches all over the body; eruptions appeared with the fever, and the patient died on the fifth day with head symptoms."

Another was reported by Baboo Kanny Loll Dey, Rai Bahadoor. "A slight eruption was noticed on the cheek, forehead, and back, on the fifth day; temperature 104 deg, pulse 120; severe headache; fauces congested. On the seventh day the rash had disappeared, and sudamina were observed, especially on the back. The fever rose towards evening; and on the eighth day bronchitis set in. The knees also became painful and swollen. The bronchitis was worse on the ninth day. There was tenderness over the colon. Patient very restless and delirious; strawberry tongue; lips dry and parched, and teeth covered with sordes; feet puffy. Death took place from exhaustion on the tenth day. Patient was a girl of fourteen years."

Dr. Jugobundoo Bose met with two or three fatal cases in 1881; but the majority of the cases observed were mild, and gave no cause for anxiety.

By way of practical illustration and summary of the symptoms of the affection, I shall relate two cases which underwent careful observation in the wards of Brigade Surgeon Coates, M.D., Principal and Professor of Medicine in the Calcutta Medical College, and First Physician to the College Hospital. The subjects were adults, and the symptoms somewhat milder than those observed in children.

"The first case, P. S. Ryan, a European male, *æt.* 27 years, by occupation a railway guard, living in 105, Lower Circular Road, was admitted into the First Physician's ward on the 29th July 1881, with a ticket from the Medical Outdoor

Dispensary as a case of rubeola. The fever attacked him two days before admission, accompanied by general muscular pain and great uneasiness. On the morning of the third day the skin of his face, neck, and chest was found to have been reddened by a kind of eruption, along with the appearance of which the fever is said to have lost its violence to a considerable degree.

"*Condition on admission.*—Body fairly nourished, but painful, particularly in the back and the loins. Tongue thickly covered with yellowish fur. The hepatic and the splenic regions painful on pressure. Bowels constipated. Appetite dull. Thirst severe. Urine scanty and high-coloured. Nothing abnormal in the throat, lungs, or sounds of the heart. Pulse excited. Skin hot, dry, and of natural hue all over except in the face, neck, front of the chest, and shoulders, with the adjacent parts of the arms, where it exhibits a uniformly spread pinkish discoloration, simulating pretty closely the condition produced by the rubefacient action of a mustard poultice. Temperature, 102.2 deg. Fahr.

"*Subsequent progress.*—The fever was continued, lasted for ten days, and passed off by lysis. The redness of the skin began to fade away from the fourth day, commencing in the chest, and then gradually disappearing from the face and neck without any subsequent desquamation of the epidermis, at least during the period the patient remained in the hospital, which he left the day after the fever had left him. The soreness of the muscles got better by degrees, but he was troubled with a severe aching pain in the right arm one night. He never complained of sorethroat or bronchial irritation.

"The treatment was that of an ordinary fever case, by purgatives, diuretics, and diaphoretics.

"The second case was an East Indian male, *æt.* 21 years, by occupation a clerk, living in Dhurumtolla Street. He was sent for admission from the Outdoor Dispensary as a case of dengue, on the 10th August 1881, which was the second day of his fever, and from the morning of which he noticed a red rash covering the skin of his face, neck, chest, and arms, in the form of a uniform blush all over.

"*On admission,* the rest of the skin of his body was found to maintain its natural colour. There were considerable headache and pain in almost all the large joints. His tongue was thickly coated; liver tender on pressure, and bowels constipated. He was suffering from high fever with dry and hot skin and diminished secretion of urine.

"The fever lasted continually for seven days, during which period he suffered a good deal from cough and sorethroat,

with a swollen, red and hyperæmic condition of the mucous membrane of the pharynx and fauces, and enlargement of the tonsils. On the fifth day the eruptions were noticed to fade away in scattered places, leaving behind patches or spots of redness which ultimately disappeared on the seventh day without any apparent desquamation of the epidermis.

"He left the hospital the day after he got rid of fever, before he was thoroughly cured of his sorethroat and joint pains.

"Treatment was chiefly diuretic and diaphoretic."

Turning now to the epidemiology of the outbreak.

1. The cases, as far as I know, were confined to the town of Calcutta and scattered pretty equally all over its area. The only tendency to grouping observed was in families where a succession of two or three cases sometimes occurred. Single cases were, however, more common. The outbreak covered a hot season, a rainy season, and a cold season. The type of the disease appeared to be somewhat affected by season, the cases which were observed in the cold weather presenting severer throat symptoms and a more acute character generally. Hygienic conditions were not observed to exercise any influence on the frequency or severity of cases. What the incidence of the disease was on the population of the town there was no means of determining. The number of cases was, judging from my own practice and the reports received from other medical men, inconsiderable as compared with the population, and the addition to the death-rate must have been very trivial.

2. Infants and children were the usual subjects, though adults occasionally suffered. There did not appear to be any distinction as regards race, class, or sex.

3. The occurrence of several cases in one family in close succession suggested infection. The infectiousness was very feeble, for some practitioners did not consider the disease to be at all infectious.

Baboo Kaylas Chunder Bose, a very intelligent and observant physician, reported an instance furnishing positive evidence of infection. A Mahomedan lad had three playmates who were in the habit of visiting him during his illness. They lived in separate houses. All three were attacked.

The impression which I gained from the circumstances observed at the time, was that the disease was mildly infectious.

4. No opportunity presented itself of ascertaining whether the disease was self-protective. But (5) it was ascertained by several observers that a previous attack of measles con-

ferred no immunity from this disease, and that it, in its turn, was not protective against measles.

Bahoo Kaylas Chunder Bose attended two lads who had had measles about two months before contracting this disease by infection. One of my own cases had suffered from a severe attack of measles some months previously. Her symptoms were very well marked and typical. Dr. Cayley saw, in January 1882, a case of measles, the subject of which has suffered from "febrile roseola" in 1881.

Such being a brief account of this disease as it was observed in Calcutta in the years 1881-1882, the question now remains—What was the nature of the malady? The symptoms presented some resemblance to measles and to scarlet fever, but there can be very little doubt that its phenomena and course, taken as a whole, differed so materially from both of these exanthemata as to place its identity with either beyond question? Measles is a very common disease in India, and breaks out epidemically every third or fourth year in Calcutta. Its symptoms are perhaps milder than in this country, and complications less severe; but the difference is entirely one of degree. An epidemic of measles had occurred in Calcutta in 1880-81, just before the commencement of the outbreak which I have described. Practitioners were therefore in a position to appreciate the differences which existed between the cases constituting these epidemics, and they had no hesitation in pronouncing the later cases to be essentially different from those of the earlier epidemic. The difference was also observed by the native community generally, inasmuch as the later disease was known among them by the name of *minmina*, the popular name of *hâm* being applied to measles. Among English physicians the later cases were denominated "roseola", "febrile roseola", "mild scarlatina", "German measles", and "dengue" (on account of the muscular pains which sometimes accompanied the fever and eruption). The points of difference between measles and rötheln, as laid down in the text-books, are—the longer incubation and shorter invasion period of the latter, the milder pyrexia, the different form and colour of the patches of eruption, the succession of crops of eruption in rötheln, one series of patches fading while another is maturating, while in measles the successive crops undergo simultaneous development and decadence. The earlier decline of both fever and eruption in rötheln, the less severe implication of the conjunctival and Schneiderian mucous membranes, and more decided affection of the tonsils and fauces in this disease, the absence of diarrhœa, the swelling of the glands of the neck, the shorter course and feebler infectiveness of

rötheln, the absence after it of sequelæ, and the want of mutual protectiveness—these constitute the principal grounds of differentiation between measles and rötheln, and most of them apply very clearly to the present case. On the other hand, scarlatina is practically unknown in India as an indigenous disease —certainly as an indigenous epidemic; and, even when cases are imported into India, as occasionally happens, by means of troopships carrying the wives and children of English soldiers, the disease very soon dies out, and never spreads among the native community. I have repeatedly made special inquiries on this subject, and raised the question in the *Indian Medical Gazette*, but without eliciting any information militating against the conclusion just stated. Cases of eruptive fever resembling scarlatina have been published, but they were quite exceptional and isolated. I have met with one such case in my own practice, and others have from time to time been related to me or published in the *Indian Medical Gazette* (see vol. xiv, p. 85, and vol. xviii, p. 73); but it may be stated with confidence that epidemic scarlatina is unknown in India. There can, therefore, be no question regarding the malady under discussion being a modified or mild manifestation of scarlet fever, or a simultaneous infection by the poisons of measles and scarlatina, or a hybrid disease, presenting features characteristic of both diseases, but corresponding closely and entirely to neither. The nature and course of the eruption and the absence of the characteristic complications and sequelæ of scarlatina would suffice, even if the disease prevailed in India, to establish a differential diagnosis.

Was the epidemic, then, one of rötheln, or were the cases merely instances of a roseolar efflorescence occurring in the course of fever of some other origin and type, say malarious, and presenting, owing to their contemporaneous occurrence, the semblance of an epidemic? The autonomy, so to speak, of rötheln is now a recognised fact. An important discussion took place on this subject at the International Medical Congress of 1881, founded on papers communicated to the section for the study of diseases of children, by Drs. Cheadle and Squire, of London; Lewis Smith, of New York; Shuttleworth, of Lancaster, and others. Dr. West, who presided over this section, and, I believe, at one time entertained a doubt as to the right of rötheln to be recognised as a separate exanthem, summed up the debate in these words: "A general consent exists as to the existence of a distinct disease, similar in some respects to, but not identical with either measles or scarlatina."

Accepting this as the established view of the profession on this subject, and taking Dr. Thomas's description of rötheln in Ziemssen's *Cyclopædia*, and Dr. Squire's in Quain's *Dictionary of Medicine*, as the most authoritative, exact, and exhaustive accounts of the disease in existence, I think there can be little hesitation in pronouncing the Calcutta outbreak which I have described to have been one of rötheln. Its symptoms were somewhat more severe and prolonged than those described by Drs. Thomas and Squire, the stage of invasion better marked and of longer duration, and the appearance of eruption consequently later, and the pyrexia earlier and more intense; but greater differences than these have been observed in recorded epidemics of rötheln, and Dr. Cheadle's paper proves that even in the same epidemic great variation in the comparative intensity of cases may present itself. Dr. Cheadle's earlier cases were very severe —the pyrexia was strong, the eruption very pronounced, and in some cases purpuric, and it is important to note that the pre-eruptive stage lasted two days, and the whole disease six to eight days, against twelve to twenty-four hours, and three to four days, according to Dr. Squire's description. He had four deaths among thirty cases. His later cases were milder, and more consonant with the text-book descriptions; but that both types belonged to the same epidemic was proved by the observation that some of the milder cases caught the infection from some of the more severe. Considerations such as these deprive the differences which I have stated between the features of the Calcutta epidemic and the text-book descriptions of significance.

The number, character, and disposition of the cases renders it extremely improbable that they were fortuitous concurrences of febrile attacks of various nature and cause, accompanied by a skin eruption simulating an exanthem. The descriptions of individual cases recorded by a number of different observers agreed so closely as to render this unlikely in the highest degree. At the same time it is right to state that an able native medical man, Dr. Jugobundoo Bose, asserted at the Calcutta Medical Society that he had observed cases of a similar kind in the rainy season during the previous ten or thirteen years; and another—Baboo Lall Madhub Mookerjee—during the preceding twenty years. I had myself never seen any similar case in India previous to 1881; and during 1883 and 1884, while my practice was equally extensive, if not more so, I did not meet with any. No doubt the skin is more sensitive in hot than in temperate climates, and dermitis more easily excited; and in the fevers of India erythe-

matous, roseolar, and miliary eruption are by no means uncommon. I have observed, for example, several cases of so-called surgical scarlatina in the Medical College Hospital. Sir James Paget has shown that persons who have undergone operation are, like puerperal women, very susceptible to the infection of scarlatina. This subject was introduced at the International Medical Congress by Mr. Howard Marsh in a very interesting paper. Mr. Holmes and others had observed instances which confirmed Sir James Paget's experience, but they had also noticed eruptions in wounded persons which could not be attributed to scarlatinal infection. The cases which I observed in Calcutta could not have been thus caused, for scarlatina, as I have stated, is unknown in India, and certainly did not prevail in the city at the time these cases occurred. And yet their phenomena resembled those of scarlatina very remarkably. They appeared to me to be of septic origin. I have noticed a somewhat similar eruption in persons convalescing from acute tetanus, and the same experience has been recorded by Dr. Cayley (*vide Indian Medical Gazette*, vol. xvi, p. 27); but while admitting that skin eruptions do occur in the fevers of hot climates more frequently than in temperate latitudes, I cannot concede that the cases which I have described in this paper were of that kind, and I am strongly inclined to conclude, for the reasons I have advanced, that they were instances of rötheln.

I should have been better satisfied if I had been able to lay before the Society a more detailed and accurate account of the disease which I have described, I fear, very imperfectly; but in the pressure of multifarious and onerous duties, systematic and searching clinical investigation is impossible. I have, however, thought it right to draw pointed attention to the experiences which I have had, and elicited, on this subject at this the fountain head of epidemiological study, with a view to urge upon those who practise the medical profession in hot climates the importance of observing and describing anomalous diseases and outbreaks of this nature. One result of the publication of the notes which I laid before the Calcutta Medical Society, and the discussions thereon in the *Indian Medical Gazette*, was the communication to the same journal of a letter by Surgeon-Major E. F. Drake-Brockman, F.R.C.S., in which he referred to an epidemic which occurred in the town of Madras in the year 1876, which he was inclined to believe was an outbreak of rötheln (*vide Indian Medical Gazette*, vol. xvi, p. 341). I hope that the greater prominence and wider diffusion which the subject

will obtain through the agency of this Society will result in eliciting information of a like kind from other places. I venture to hope, also, that I shall be favoured with the views and judgment of members of the Society on the subject matter of this paper.

THE PREVENTION OF HEAT APOPLEXY.

By Surgeon-General A. C. C. DE RENZY, C.B.

(*Read: March 11th*, 1885.)

As so many of our troops will soon be exposed to the trying ordeal of a Soudan summer, I have thought it might interest the Society to hear something of the experience of one who has resided for some years at one of the hottest places in the world as to the prevention of heat apoplexy. My experience of this disease was mainly obtained at Multan, the climate of which closely resembles that of the Soudan in the intense heat of its summer and the extraordinary dryness of its atmosphere. My charge consisted of European troops, European railway *employés*, European civil officers, women and children, and large bodies of natives.

In the month of June, at Multan, the temperature in the shade reaches 120 deg. Fahr., and a black bulb thermometer *in vacuo*, raised three feet above the ground, registers 176 deg. Fahr. An ordinary thermometer exposed to the sun's rays registers 157 deg. Fahr. The dryness of the air is extraordinary. The mean humidity of the month of May, deduced from observations taken at 9 a.m., 3 p.m., and 9 p.m., is only 26, and the minimum humidity has been found as low as 17, saturation being=100. Dust storms occur at very short intervals all through the hot weather, which lasts from May to September. The darkness caused by these dust storms is often so dense that it is impossible to see one's uplifted hand. The nights are comparatively cool. In June, the hottest month, the minimum thermometer goes down to 71 deg. Fahr. About 10 o'clock p.m. the sky becomes perfectly cloudless, and the earth radiates the heat stored up during the day very rapidly; but there are usually three or four extremely hot nights in the year when the clouds do not disperse, and so radiation is obstructed. On such occasions I have found my bed so scorching hot that I have had to have water sprinkled over it to make it tolerably cool. The mean daily range of May is 34.43 deg. Fahr. So far as I can gather, the climate of the Soudan is neither so hot nor so dry

as that of Multan, nor is it at all so trying; and if it can be shown that a very fair standard of health can be secured for British troops at Multan, we may hope that, so far as the high temperature is concerned, a similar result is not beyond the possibility of attainment for the troops in the Soudan. It would hardly be expected, *a priori*, that British troops could be healthy exposed to such climatic conditions as I have described, and yet it is an indisputable fact that Multan has long been one of the healthiest stations in Northern India. Taking the returns for the last eighteen years, it stands fifth in the order of healthiness as deduced from the death-rate. Bareilly stands first, with a death-rate of 12·01 per mille; Fort William second, with a death-rate of 12·33 per mille; while the death-rate of Multan was 15·15 per mille, or actually less than the death-rate of the troops stationed in these islands was thirty years ago. If the mortality from heat apoplexy were reduced, as I believe it could be, Multan, notwithstanding the excessive heat of its climate in summer, would be one of the stations of lowest death-rate in the world for British troops.

It is worthy of mention here, in connection with the Soudan campaign, that a British force besieged Multan all through the summer of 1848, and I am informed, by one who took part in the siege, that the troops had very little sickness, and few casualties from heat apoplexy. Lord Gough, who was Commander-in-Chief in India at that time, was altogether opposed to the place being invested in summer, as he thought it impossible the troops could withstand the heat. The result proved that his apprehensions were unfounded. With good tents, a good commissariat, and arrangements well adapted in other respects for the protection of the health of the troops, the campaign was brought to a brilliant close by the storm of the fortress, one of the strongest in India.

Heat apoplexy causes a large amount of mortality among the British troops in India. It is impossible to state the amount with precision, owing to the fact that in the statistical returns the deaths from that cause are included under the head of apoplexy, which is quite a different disease. But as apoplexy proper is a disease of somewhat advanced life, while the army, of late years especially, is composed of very young men, my belief is that the great majority of the deaths entered under the head of apoplexy are really due to heat apoplexy. In 1869 the apoplexy deaths numbered 131; in 1872, 114; in 1875, 101; in 1879, 128; and in 1880, 161. Taking one year with another, they number about 100 deaths a year.

Heat apoplexy has been so well described in Dr. Maclean's article in Reynolds's *System of Medicine*, and in Sir Joseph Fayrer's article in Quain's *Dictionary of Medicine*, that it is unnecessary to define it in detail here. Its prominent features are loss of consciousness and high body temperature, often reaching very rapidly to 109 or 110 Fahr. Pulmonary congestion, often amounting to pulmonary apoplexy and engorgement of the right side of the heart, are the almost invariable sequels of the disease.

The disease occurs under two very different conditions—(1), under exposure to the direct rays of the sun; and (2), under exposure to great heat in the shade.

The deaths under the second head are far more numerous than under the first. For the prevention of the former class of cases two things are indispensably necessary—(1), that the clothing be loose and light, so as not to interfere with the free movements of the chest, nor with evaporation from the skin, and so as not to obstruct the circulation in the cervical blood vessels; and (2), that a supply of drinking water should be always at hand to relieve the first signs of thirst.

My first experience of heat apoplexy greatly impressed me with the importance of having the clothing loose and the chest and neck free of all constriction. In April 1852 a British force landed at Rangoon and proceeded at once to attack the White House Stockade. The day was intensely hot, and the sun shone forth with terrible power, as there was not a cloud in the sky. The artillery was furnished partly from the Bengal Army, partly from Madras; and in these days there was a good deal of healthy rivalry between the two armies. The work of landing the guns and ammunition from the ships was very laborious, and the men worked with a will. The Bengal men, having got their guns ashore, went rapidly to the front in their shirt-sleeves, and got into action some time before their Madras comrades, who delayed, to get on their blue cloth uniform and leather stocks. The Madras men had not been long in action when many of them began to drop down insensible from heat apoplexy—their commanding officer being among the number—while the Bengal men had not a single case.

Dr. Maclean mentions a case very similar to this, that of H.M. 98th Foot, at Ching Kiang Foo, which, encumbered with the old leather stock and tight-fitting cloth clothing, suffered severely, while the Royal Irish Regiment, without those impedimenta, suffered hardly at all. He also mentioned a case that occurred in 1834, at the funeral of a

general officer, when several men fell senseless under like circumstances. I think it will be found that whenever outbreaks have occurred in recent times in India, under exposure to the direct rays of the sun, the occasion was one of ceremony, such as a funeral, or a guard of honour, or a church parade, when the dress of the men was more elaborate than it is on ordinary occasions, and they were encumbered with accoutrements which constricted the chest or neck, and interfered with the cooling of the body by evaporation from the skin.

As regards the importance of having a supply of drinking water ready at hand for the use of men under exposure to the direct rays of the sun, I think it is impossible to exaggerate it. This is a matter which Europeans in hot climates greatly neglect, while natives are very careful about it; and to this difference in the behaviour of the two races, co-operating, no doubt, with the acclimatisation of the native constitution, I am disposed to attribute the comparative immunity of the natives from heat apoplexy. It is very remarkable that while the deaths classed under the head of apoplexy amount to 20 per 10,000 for European troops, they amount to only 2 per 10,000 for native troops; and this, it should be stated, although there is a considerable number of men advanced in life in the ranks of the native army. The arrangements for the supply of water for men on field service are extremely defective. The Bhistis exhibit the greatest courage in supplying the troops, often under the heaviest fire, and our men have often shown their grateful appreciation of such devotion. One instance of this appreciation deserves mention. When, after the capture of Lucknow, a British cavalry regiment was directed by Lord Clyde to nominate the man in the corps whom the men considered most deserving of the Victoria Cross, the Bhisti was unanimously selected for this high distinction.

I have little doubt that many of the deaths from heat apoplexy on field service are due to the inability of the men to get water when thirst indicates the need of it. Careful observations have shown that the temperature of a man walking for some hours under a hot sun rises several degrees; and if the exertion be continued without the use of water, the action of the heart becomes weaker, the pulmonary circulation becomes obstructed, the veins of the head grow turgid. These symptoms develop gradually, almost imperceptibly, but the resulting disease, heat apoplexy, makes its appearance suddenly. In an atmosphere so intensely dry as that of Northern India, the loss of water by evaporation from

the skin is very large, and unless the loss is replaced before it has gone too far, the health fails irreparably. I have often been astonished at the immense quantity of water natives drink under exposure to the sun, and I have little doubt their power of bearing exposure is greatly due to this practice.

There are several facts which show that Europeans may be exposed to the sun with little or no risk. In the first place, heat apoplexy is comparatively rare among officers who take the proper precautions against it. I myself have seen only two cases. One was the case of the commandant of the Madras Artillery already referred to. The second occurred on the night of the Mutiny at Nusserabad, in 1857. The night was intensely hot, and the officer, left for some time without water, was struck down as he was getting along in his buggy. Everyone of Indian experience must have known of great sportsmen who were in the habit of going out shooting in the hottest weather, and without any injury to health. These men were careful to have their dress loose and light, and to have something to drink at hand. Cold tea was a favourite drink with many sportsmen of my acquaintance. I have only known one case in an officer's wife. She was attacked when travelling on the Indus on a terribly hot day. The tea planters of Assam furnish a remarkable illustration of the safety with which Europeans may expose themselves in the hottest sun. Tea planters are a large class, and their duties require them to be out in the hottest season and at the hottest time of the day. In Assam, the principal tea district of India, the sun is very powerful. In Sibságar, which may be taken as the type of the Assam tea districts, the black bulb thermometer registers 165 in the sun's rays. I asked my friend, Mr. Berry White, who for upwards of twenty years had a large practice among Assam tea planters, to what extent they were subject to heat apoplexy. His answer was that he had never known of a case in Upper Assam.

One's own personal experience ought not to count for much in judging of questions of health, except when it is found to accord with experience on a large scale. My duties at Multan made it necessary for me to be out very frequently in the hottest time of the day, and yet, in the seven years of my residence at that station, I was never a single day off duty. In later years I had to make long journeys, riding on elephants, camels, or on horseback, exposed to the full power of the sun all day, but without any injury to my health. On those journeys cold tea was my usual beverage. Besides being good for quenching thirst, tea seems to have the

property of keeping the blood cool by forcing perspiration. But in recent times, since the soldiers' clothing has been so much improved, cases of heat apoplexy that occur from exposure to the direct rays of the sun are comparatively rare. The great majority of the cases occur from exposure to great heat between sunset and midnight, and not at the period of greatest heat, which is between two and three o'clock p.m.

In the case of British soldiers two circumstances concur to produce this result. In the first place, a marked change occurs in the meteorological conditions. The breeze, which is usually brisk during the day, fails towards sunset. During the day the anemometer registers an air velocity of from five to seven or eight miles an hour. About sunset it shows no movement whatever. At the same time clouds appear, and if low and dense, they cause a very stifling sensation by their interference with radiation. I remember a very serious outbreak of heat apoplexy at Multan in 1865, in which these conditions were very marked. It was nine o'clock p.m.; temperature, 107 deg. Fahr.; air motionless—intensely dry; sky covered with dense black clouds at a very low elevation. I had just written up my meteorological register, when I said to some friends who happened to be with me at the time, that it would be strange if there were not some cases of heat apoplexy that night. The words were hardly out of my mouth when I was sent for to see one, and within the next few hours there were a dozen or more cases in the station, most of which proved fatal.

Concurrently with these unfavourable meteorological conditions a dangerous social arrangement comes into operation. The canteen opens, and the men, thirsty from the heat of the day, eagerly crowd into it. The ventilation of the canteen is far short of the requirements of the number of men who now flock into it. The air becomes loaded with the products of respiration, and to these are added the fumes of alcohol.

In the summer of 1865, which was one of extraordinary heat all over India, and in which heat apoplexy was very fatal, I went one evening to the canteen of my men, and remained a spectator of the scene for some time. The room was crowded to excess, the air was most stifling, and I left the place with a splitting headache. As the conditions I saw on that occasion are very common all over India, I have often wondered that heat apoplexy is not more prevalent than it is. I had an order at once issued that my men were not to be allowed to enter the canteen at all in the evening, and that their liquor was to be served out to them as they sat outside in the open air. The men who were subject to this régime appeared to thrive through the trying summer of 1865 without a single

case of heat apoplexy, while the regiment that lay alongside of them suffered severely. Overcrowding in a hot atmosphere strongly favours the production of heat apoplexy, and ought to be most carefully guarded against. Even when the men are in the open air it is advisable not to collect them in dense masses during hot weather.

And here I cannot but remark *en passant* that, in my opinion, the square formation of attack lately adopted in the Soudan must have strongly predisposed the men to heat apoplexy.

The use of alcoholic liquor in other than very moderate quantity strongly favours the production of the disease. Fully three-fourths of the cases that I used to see among the drivers and guards of the Scinde, Punjab, and Delhi Railway occurred among men who had been drinking freely. There cannot be a doubt that the use of alcohol lessens the power of resisting the action of high temperature on the body, and it is probable that the prophet of Islam was aware of its injurious effects when he made total abstinence an article of religious obligation on his followers. In the burning heat of an Arabian summer intemperance would be attended with disastrous effects. In the impure atmosphere of the hot, crowded canteen even a very moderate excess in the use of alcohol is attended with great danger to life.

Another cause which determines the great frequency of heat apoplexy among British soldiers after sunset, is the intense heat of the barracks. The radiation of the heat collected in the walls during the day, and the failure of the breeze, make the barracks feel like ovens. By ten o'clock the temperature of the barracks is often 5 or 6 deg. Fahr. higher than that of the air outside. It is difficult to convey to one who has not had personal experience of it, a correct impression of the stifling sensation excited in one on going, in the hot weather, from the open air into a barrack some time after sunset, more especially if, as often happens, the ventilating windows have not been opened. In order to protect my men from barrack heat at night, I was for some years in the habit of insisting on their sleeping in the open air; and in the dry air of Multan, when for four months there is no dew whatever, this practice was highly beneficial. But there is a very general impression that exposure to the night air is not healthy,—that it favours the action of malaria, predisposes to rheumatism, etc. When the air is dry this impression is, I think, quite unfounded. It is certainly opposed to the experience of the natives of the Punjab, where the practice of sleeping in the open air in the hot weather is universal. The

flat roofs of the houses are used for sleeping on, and men, women, and children may be seen lying asleep on their charpoys in the streets. The cool, refreshing sleep so obtained would be impossible in the hot, still atmosphere of the interior of the house; and yet I have repeatedly heard of the troops not being allowed to sleep outside their barrack, on the ground that exposure to the night air was injurious.

Some years ago, in order to provide the means of readily cooling the barracks at Peshawar at night, I proposed that the water supply should be so arranged that a jet could be laid on to give the buildings a thorough douching after sunset. That station was particularly favourable for an experiment of the kind. The heat is intense, and the air, all through the hot weather, is very nearly as dry as that of Multan, which I have already described. An abundant supply of good water was to be got at a very moderate cost, and at an elevation which would have admitted of the jet being worked under a pressure of 200 feet. But, although my proposal had the approval of so high an authority as Mr. Edwin Chadwick, I was not able to secure any attention for it in India, and the barracks in Peshawar still continue bake-houses. At private residences the custom is universal for the Bhisti to sprinkle water from his mussack on the ground after sunset, for the purpose of laying the dust. I have often been surprised at the cooling, refreshing effect which even the small quantity of water that is provided under this system produced. If the walls, roofs, and floors of buildings were douched in the manner I proposed, the rapid evaporation would cool the buildings. A fall of half a tenth of an inch of rain has an extraordinary cooling effect in the dry atmosphere of the Punjab.

The plan I propose would, of course, be quite impracticable under existing arrangements in Indian cantonments, where all the water used has to be carried often from a considerable distance by either bullocks or Bhistis; but the conviction is, I believe, rapidly growing that this barbarous system must be abandoned, and water provided under pressure, if the troops are to be protected against the ravages of cholera and typhoid fever.

Whenever this change is adopted there will be no difficulty in douching the barracks in the manner I suggest. I venture to hope that some of the members of the Society will favour the meeting with an expression of their opinion as to the feasibility and value of this proposal.

In conclusion, I submit that experience in the hottest parts of India justify the hope that, under good arrangements, the

losses from heat apoplexy among the troops in the Soudan may be kept within very moderate limits. With good tents of the Indian pattern, attention to clothing, good arrangements for the supply of water, avoidance of overcrowding, especially in tents or huts, and extreme moderation in the use of alcohol, I should feel very hopeful that the losses from heat apoplexy would be very small.

THE SEASONAL PREVALENCE OF CONTINUED FEVERS IN LONDON.

By G. B. LONGSTAFF, M.A., M.B.

(*Read: April 8th*, 1885.)

But fifty years ago the various species of continued fevers were commonly confounded together, and, as a natural result, different writers gave most conflicting accounts of the symptoms and course of the disease generally termed *typhus*, and likewise of the morbid appearances found after death. The honour of disentangling the confusion is mainly due to Gerhard (1837), Stewart (1840), and Jenner (1849).

In 1854, Murchison entered the arena, and made various contributions to the voluminous literature of the subject; his classical *Treatise on the Continued Fevers of Great Britain* was published in 1862, and a second edition appeared in 1873. In this work, and in his lectures, Murchison laid great stress upon the etiological distinctions between the different fevers, and exhibited with this view, in a series of tables and diagrams, the weighty statistics of the London Fever Hospital, which showed, among other points, that, as a rule, typhus and enteric fevers prevail at different seasons of the year.

In the Registrar-General's returns the various forms of continued fever were classed together under the head of "typhus" or "fever", until 1869.

In Table I are shown the deaths in London from "fever" during a period of forty-eight years, taken from the "Annual Summaries"; also the death-rates per 1,000 estimated to be living in London in each year have been calculated. It is at once seen that, in spite of the enormous increase of population, the absolute loss of life from "fever" is less now than it was ten years ago; much less than it was twenty, thirty, or even forty years ago. When allowance is made for the increase of population, it appears that the mortality from this cause has, during the last sixteen years, been but forty per cent. of what it was during the sixteen years ending with 1852. The decrease has been almost uninterrupted since 1864.

In Table II are shown similar facts from the same sources, but under the three headings first adopted by the Registrar-

General in 1869, viz., Typhus, Simple Continued, and Enteric Fevers.

The first point to notice is, that during the sixteen years typhus was made accountable for 3,332 deaths; simple continued fever for a considerably larger number, 4,374; but enteric fever for more than twice as many deaths as the other two diseases put together, viz., 14,430.

Secondly, whereas in the earlier years typhus was accredited with about the same number of deaths as simple continued fever, and enteric fever with a number only half as large again, latterly the proportions have been very different: typhus now numbers only half as many victims as simple continued fever, whereas enteric fever claims ten times as many. In other words, the death-rates per 1,000 show that whereas the relative mortality from simple continued fever is but one-tenth of what it was, and that from typhus only one-twentieth, the fall in the enteric fever rate only amounts to thirty per cent.

The great diminution in the fever mortality of London is, then, mainly due to the diminished prevalence of typhus and simple continued fevers, while the mortality from enteric fever has remained for ten years comparatively stationary.

Typhus fever is a definite and well-known disease; it is far otherwise with simple continued fever.

Murchison says, "Simple continued fever, when uncomplicated, is rarely, if ever, fatal in this country. The numerous deaths from simple fever recorded weekly by the Registrar-General are due, for the most part, to enteric fever, with latent abdominal symptoms."*

Again, "Many cases are designated simple fever or febricula which are, in reality, mild or abortive cases of typhus or enteric fever, or relapsing fever without the relapse, or catarrh with an unusual amount of febrile disturbance."†

Again, "Medical men often decline to call a fever 'enteric', in which, as often happens, there are no enteric symptoms, and hence the intestinal lesion is apt to be overlooked until it unexpectedly becomes a source of danger. This mainly accounts for the circumstance that in the returns of the Registrar-General deaths are weekly ascribed to 'simple continued fever', a disease which in twenty-five years has not once been fatal in the London Fever Hospital."‡

Again, he states "that the cases of febricula admitted into the London Fever Hospital during the twenty-three years, 1848-70, amounted to 2,232."§

* *Continued Fevers* (2nd ed.), p. 682.
† *Op. cit.*, p. 678.
‡ *Op. cit.*, p. 420.
§ *Op. cit.*, p. 684, table.

On the one hand we have the emphatic and reiterated statement of a deservedly respected authority, founded upon vast experience; on the other the opinion of the large body of medical men in London, who certified that 4,374 deaths in the last sixteen years were caused by this disease—simple continued fever.

It is now ten years since Messrs. Buchan and Mitchell, in the *Journal of the Scottish Meteorological Society*, compared the seasonal prevalence in London of the three forms of continued fever. The curves they obtained were based on but six years' results. Concerning typhus they remark, "It is, however, a curve which calls for clearer definition from future observations, though it seems probable that it has two maxima, the larger in the early months of the year, and the smaller in the height of summer." Of simple continued fever they say, "This curve.....is not very satisfactory, and further observations are required to define it with greater precision."

More facts are now available, and I have set these forth in the accompanying diagram, viz.:

(1) Monthly admissions to the London Fever Hospital for the twenty-three years, 1848-70.* These are available for typhus and enteric fevers only. See Table III.

(2) Weekly deaths in London during the six years, 1869-75.† See Table V.

(3) Weekly admissions to the hospitals of the Metropolitan Asylums Board for the ten years, 1875-84. From the returns supplied to the Registrar-General, and published in the weekly reports. Give typhus and enteric fevers only. See Table IV.

(4) Weekly deaths in London during the ten years, 1875-84. From the weekly returns of the Registrar-General. See Table V.

In the diagram the blue curves relate to typhus, red to simple continued, and yellow to enteric fever.

The curves show the average deviation per cent. from the mean, the dark colour indicating excess, the light colour defect.

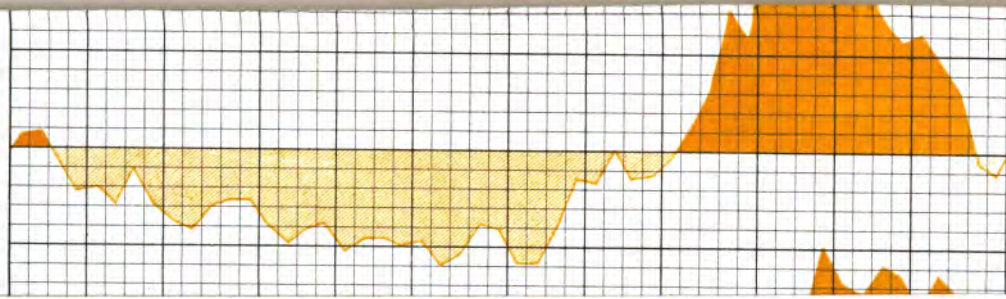
The curves are all strictly comparable, being on one uniform scale, each small division corresponding to ten per cent. deviation from the mean.

The actual mean weekly or monthly number of admissions or deaths is given in figures on the right hand.

* Murchison, *Treatise on the Continued Fevers of Great Britain* (2nd ed.), pp. 66, 446.

† Buchan and Mitchell, *Journal of the Scottish Meteorological Society* (Feb. 1875), p. 256.

Weekly **ADMISSIONS**
to the Metropolitan
Asylum Board
HOSPITALS



8.

AVERAGE
Ten Years
1875 - 1884

In the case of typhus and simple continued fevers, I have considered it best, as the numbers are small, to deal with *months* in preference to weeks. As (with the exception of the London Fever Hospital statistics) the available figures are given for weeks only, the number taken to represent January is the sum of the first four weeks of the year, February the second four weeks of the year, and so on; but for March, June, September, and December the number taken is four-fifths of the sum of the *five* weeks taken to correspond to these months. For the purposes in hand it is necessary to consider the months as of equal length; but as there are fifty-two weeks in the year, it is necessary to drop out four weeks. This may seem a complicated arrangement, but it is really simple, and does not materially affect the accuracy of any conclusions drawn.

The first point to note is that the various curves derived from different sets of figures, and relating to different periods, give in the main concordant results in the case of each disease. This general agreement—which is, indeed, in the case of enteric fever, very close, and in the case of typhus sufficiently marked—is in itself a proof that these diseases are, in some way or another, directly or indirectly influenced by season; and that they are differently influenced is evident, for enteric fever, whether measured by hospital admissions or by deaths, is most prevalent in the autumn, whereas the other diseases show a preference for winter and spring.

As the curves of enteric fever are most definite, and as that disease is now the most fatal form of continued fever, it will be convenient to consider it first.

The curves of hospital admissions in the main agree. In both the curve is decidedly below the average from the beginning of March to the end of July, and as decidedly above the average in the last four months of the year.

In two respects they differ: in the older returns of the London Fever Hospital the admissions were much above the mean during August; in the later returns of the hospitals of the Metropolitan Asylums Board somewhat below. Again, the admissions to the former hospital were about equal for September, October, and November, whereas in the latter the October admissions were by far the most numerous. An explanation of one at least of these discrepancies is not far to seek. The Metropolitan Asylums Board have, actually or potentially, an indefinite amount of accommodation; hence, in all probability, the number of admissions is a true measure of the prevalence of the disease, and the curve resulting is some measure of the real influence of

season on the epidemic. On the other hand, in the case of the London Fever Hospital, it is far otherwise; the amount of available accommodation is strictly limited. In the earlier stages of the epidemic all cases are admitted, but no doubt, as the cases become more numerous, a portion of them have to be refused admission. The hospital is constantly full during several weeks when the epidemic is at its height, and so the true maximum is not represented in the curve; moreover, by the same process the horizon of the mean is lowered, and a glance at the second curve shows that if its mean were lowered a little, the July mortality would appear above the average, and so correspond with the other curve.

As regards two mortality curves for enteric fever, it may be noted that, as we might expect, the second curve, representing, as it does, the figures of a much longer period, is "smoother", and probably truer than the first. But, in spite of minor differences, the general agreement of these curves with one another, and with the curves of admission, is very striking, and generally it may be stated that:—In the case of enteric fever the disease is least prevalent in late spring and early summer; the rise from the minimum may occur gradually as early as May, or suddenly as late as July; that it sometimes exceeds the mean of the year in August, always in September, and reaches a maximum about the end of October or beginning of November; from that point it declines more or less rapidly, usually reaching the mean again about the close of the year, and then declining with occasional small outbreaks throughout the first three months of the year to its minimum.

It may be remarked that, as shown by the smaller diagram, the curves of enteric fever, although not identical with, show a very close approximation to, those of scarlet fever. See also Tables IV and VI.

The most essential difference between the two curves is, I take it, that in the case of scarlatina, the rise from the minimum to the maximum is longer and more gradual than in the case of enteric fever.

This great resemblance between the curves should be kept in mind; but although we can say that scarlatina and enteric fever are both, whether directly or indirectly, greatly influenced by season, and are, moreover, affected in a very similar manner, and even to precisely the same extent (so far at least as the mortality curves go, the maxima and minima in the two cases being identical), I do not consider that any other inference is justifiable.

Next let us examine the typhus curves. The numbers being,

with the exception of the admissions to the London Fever Hospital, very small, it seemed better to deal with months rather than weeks.

The two sets of hospital statistics are scarcely liable to errors of careless or incompetent diagnosis, and, as might be expected, give better curves than the Registrar-General's figures. The hospital returns agree in the main; they both show the mortality from typhus to be below the average in the five months, June to October inclusive, and above the average in the four months, November to February inclusive. The earlier returns give a much greater number of cases for March, April, and May than the later. According to the first curve, the maximum is in January; according to the second, in February.

The two curves of deaths agree in representing the mortality as below the average in May, August, and September, and above the average in the first four months of the year, and in October. The most striking discrepancies are in July and November.

If we attempt to combine the four curves, we may perhaps say that:—The mortality and the admissions to hospitals from typhus are at a minimum in July, August, or September; from this minimum they increase to an autumn maximum, usually in November, but it may be in October; they usually continue excessive throughout the winter, and another maximum is reached in January or February, which commonly exceeds the autumn maximum. The fall is irregular; it may be sudden in March, or more gradual and as late as May.

Typhus is more infectious than enteric fever; its outbreaks are of less frequent occurrence, but may be much more severe. It is not nearly so much influenced by season as scarlatina or enteric fever, but so far as it is influenced it may be described as a disease of late autumn, winter, and early spring.

Lastly, as regards simple continued fever, the only facts to go by are the London deaths. The numbers are small and the curves very irregular, and not very concordant. The fluctuations from the mean are even smaller than in the case of typhus. December, January, March, and in the first curve, February, are months of high mortality; June and August, months of low mortality.

The statements of Murchison quoted above would have led us to expect some indication at least, in the simple continued fever curves, of the well-marked autumnal maximum of enteric fever, but *there is not a trace of this.*

On the other hand, there is some sort of resemblance between this curve and that of typhus mortality; and, indeed, if the two typhus curves are combined, and also those of simple continued fever, this resemblance becomes very marked. In both the minimum is in August, the maximum in January; in both the mortality is decidedly low from June to September, and decidedly high in January, February, and March.

It is not disputed that the deaths ascribed to simple continued fever are largely, probably mainly, due to something very different, and that, were it not for ignorance and carelessness in diagnosis, the deaths would have been registered in still smaller numbers than has been the case of late, but it does not, therefore, follow that these deaths have been mainly due to enteric fever. I contend that the diagram proves that but a very small proportion of them can be attributed to that cause.

Among diseases, the true nature of which may conceivably be overlooked, there might be suggested, in addition to typhus and enteric fevers, the following:—General tuberculosis, septicœmia, pneumonia, intermittent fever. It must be remembered that it is easier to diagnose the presence of *fever* than to ascertain its cause.

Incidentally the figures obtained for the purpose of this paper throw light on the extent to which the hospitals of the Metropolitan Asylums Board are made use of. Mr. A. C. Waters, of the General Register Office, has prepared for me a table (Table VII) showing for each of the last ten years the total deaths in the metropolis from enteric fever, typhus, and scarlet fever; also the deaths in the hospitals of the Metropolitan Asylums Board for the same years, and the percentage that the latter are of the former. This shows that, as regards enteric fever, a proportion varying from 7 to 11 per cent. of the deaths has occurred in the hospitals; as regards typhus, the proportion has varied from 7 to 49 per cent. (in 1882); and as regards scarlet fever, from 3½ to 16½ per cent. In the case of the two former diseases the proportion treated in the hospitals of the Board has increased of late years, but in an irregular manner and not to a very great extent.

In the case of scarlet fever the increase has been steady and very marked. In the first three years of the period the hospital deaths averaged less than four per cent. of the total; in the last three years over twelve per cent.

In Table VII are given the ratios of the total deaths in London to the admissions to the hospitals,—another way of measuring the work done by the latter. There is no

means at present of ascertaining the total number of *cases* in London.

My conclusions may be shortly stated.

(1) The mortality from enteric fever has not materially diminished in London during the last twelve years.

(2) The mortality from both typhus and simple continued fever has decreased very greatly during the same period.

(3) Enteric fever is by far most prevalent in the autumn, and the average weekly hospital admissions, and mortality in the metropolis, can be expressed as well-defined curves, having a maximum at the end of October or beginning of November.

(4) The curves of enteric fever strikingly resemble those of scarlatina, but differ in one important respect. The minimum in the case of the latter disease occurs in March or April, and the ascent from that time to the autumn maximum is very gradual; but in the case of enteric fever the minimum occurs in June or July, and the ascent to the maximum is comparatively sudden; the converse being the case as regards the descent to the minimum.

(5) The statistics of typhus and simple continued fevers, so far as figures are available, do not yield well-defined curves of seasonal prevalence. The curves, such as they are, bear no resemblance to those of enteric fever.

(6) Typhus fever is often prevalent in late autumn, but is rather a disease of winter and spring. In early autumn, when enteric fever is approaching its maximum, typhus fever is far below its average.

(7) Simple continued fever is a term applied in a great many cases in error, since, though deaths are often attributed to it, it is but rarely, if ever, fatal in fever hospitals.

(8) The statistics of the last sixteen years show that the deaths attributed to simple continued fever, however they may be really caused, are not due to enteric fever, at least not any considerable proportion of them.

(9) The hospitals of the Metropolitan Asylums Board deal with an increasing proportion of the cases of infectious diseases in the metropolis, the increase being most marked in the case of scarlatina.

(10) During the last two years, 1883 and 1884, the deaths in the said hospitals have amounted, in the case of enteric fever, to nearly 10 per cent. of the total deaths from that cause in the metropolis, in the case of typhus to 19 per cent., and in the case of scarlatina to 14 per cent., respectively.

It is hoped that the tables are free from errors. Some

small apparent discrepancies are due to the fact that in calculating the percentages the figures were, in some cases, worked out by the calculating machine to several places of decimals, but the figures given in the tables are the nearest whole numbers.

TABLE I.

Deaths from Continued Fevers in London; also Death-Rates per 1000 *living from the same in each of the forty-eight years*, 1837-1884.

Year.	Deaths.	Rate per 1000.	Year.	Deaths.	Rate per 1000.	Year.	Deaths.	Rate per 1000.
1837	1933*	2.12*	1853	2701	1.10	1869	2414	0.76
1838	4078	2.20	1854	2715	1.09	1870	2053	0.64
1839	1819	0.96	1855	2375	0.94	1871	1746	0.54
1840	1262	0.66	1856	2674	1.04	1872	1340	0.41
1841	1151	0.59	1857	2203	0.84	1873	1549	0.46
1842	1174	0.59	1858	1902	0.71	1874	1554	0.46
1843	2083	1.03	1859	1796	0.66	1875	1257	0.36
1844	1696	0.82	1860	1392	0.51	1876	1160	0.33
1845	1301	0.62	1861	1754	0.63	1877	1262	0.35
1846	1796	0.84	1862	3635	1.28	1878	1385	0.38
1847	3184	1.46	1863	2892	1.00	1879	1058	0.29
1848	3569	1.60	1864	3689	1.26	1880	901	0.24
1849	2479	1.09	1865	3232	1.09	1881	1186	0.31
1850	1967	0.85	1866	2681	0.89	1882	1118	0.29
1851	2404	1.02	1867	2174	0.71	1883	1104	0.28
1852	2209	0.92	1868	2483	0.80	1884	1045	0.26
Total, 16 years	34105		Total, 16 years	40298		Total, 16 years	22136	
Average	2132	1.07	Average	2519	0.91	Average	1384	0.40

* Six months only.

TABLE II.

Deaths from Typhus, Simple Continued, and Enteric Fever in London, and also death-rates per 1,000 *living from the same diseases, in each of the sixteen years,* 1869–1884.

Year.	Typhus.		Simple continued.		Enteric.	
	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.
1869	724	.23	635	.20	1,055	.33
1870	468	.15	609	.19	976	.30
1871	398	.12	463	.14	885	.27
1872	175	.05	341	.10	824	.25
1873	284	.08	344	.10	921	.27
1874	312	.09	359	.11	883	.26
1875	128	.04	312	.09	817	.24
1876	159	.05	232	.07	769	.22
1877	157	.04	204	.06	901	.25
1878	151	.04	201	.06	1,033	.28
1879	71	.02	168	.05	819	.22
1880	74	.02	125	.04	702	.19
1881	92	.02	123	.03	971	.25
1882	53	.01	90	.02	975	.25
1883	51	.01	90	.02	963	.24
1884	31	.01	78	.02	936	.23
Total	3,332		4,374		14,430	
Average	208	.06	273	.08	902	.25

TABLE III.

Admissions to the London Fever Hospital in each month during the twenty-three years, 1848–1870.

	Typhus Fever.			Enteric Fever.		
	Twenty-three years.	Average.	Percentage of Mean.	Twenty-three years.	Average.	Percentage of Mean.
January	1,976	85.9	**130**	433	18.8	**87**
February ...	1,621	70.5	**106**	306	13.3	**61**
March	1,906	82.9	**125**	318	13.8	**64**
April	1,642	71.4	**108**	209	9.1	**42**
May	1,525	66.3	**100**	232	10.1	**47**
June	1,296	56.3	**85**	335	14.6	**67**
July	1,251	54.4	**82**	434	18.9	**87**
August ...	1,183	51.4	**78**	721	31.3	**144**
September...	1,162	50.5	**76**	803	34.9	**161**
October	1,429	62.1	**94**	839	36.5	**168**
November ...	1,667	72.5	**110**	819	35.6	**164**
December ...	1,610	70.0	**106**	539	23.4	**108**
Total	18,268	...	...	5,988		
Mean	1,522	66.2	**100**	499	21.7	**100**

TABLE IV.—*Average weekly admissions to the Hospitals of the Metropolitan Asylums Board during the ten years*, 1875–1884.

Week.	Month.	Typhus.		Enteric Fever.		Scarlatina.	
		Average Deaths.	Percentage of Mean.	Average Deaths.	Percentage of Mean.	Average Deaths.	Percentage of Mean.
1st	January	2.6	125	8.6	106	24.5	94
2nd	„	3.0		8.7	108	23.9	91
3rd	„	2.0		7.7	95	22.3	85
4th	„	2.3		6.3	78	21.6	82
5th	February	4.1	150	6.5	80	25.9	99
6th	„	2.3		5.7	71	19.8	76
7th	„	2.3		7.2	89	17.6	67
8th	„	3.2		5.8	72	18.1	69
9th	March	2.0	95	5.0	62	19.2	73
10th	„	1.8		4.7	58	17.2	66
11th	„	1.8		5.5	68	16.4	63
12th	„	1.3		5.9	73	16.9	65
13th	„	2.4		5.9	73	15.6	60
14th	April	1.7	95	4.8	59	15.2	58
15th	„	1.8		4.1	51	19.4	74
16th	„	1.3		4.7	58	17.2	66
17th	„	2.7		4.9	61	17.9	68
18th	May	1.8	75	3.8	47	17.7	68
19th	„	1.2		4.2	52	18.9	72
20th	„	1.2		4.4	54	18.5	71
21st	„	1.6		4.0	50	16.9	65
22nd	June	2.4	90	4.3	53	23.5	90
23rd	„	1.4		3.3	41	22.0	84
24th	„	1.0		3.7	46	23.3	89
25th	„	2.4		4.9	61	24.8	95
26th	„	1.6		4.7	58	23.7	90
27th	July	1.0	60	3.4	42	25.6	98
28th	„	1.6		3.3	41	25.4	97
29th	„	1.1		4.8	59	27.4	105
30th	„	1.1		6.8	84	26.9	103
31st	August	1.2	70	6.6	82	28.0	107
32nd	„	0.5		8.0	99	29.7	113
33rd	„	2.0		6.8	84	28.9	110
34th	„	1.7		7.0	87	31.4	120
35th	September	0.8	85	7.7	95	26.2	100
36th	„	1.2		9.0	111	34.3	131
37th	„	2.4		10.6	131	35.5	135
38th	„	2.6		13.8	171	39.3	150
39th	„	1.6		12.7	157	38.1	145
40th	October	1.7	95	16.8	208	35.9	137
41st	„	1.9		17.1	212	38.7	148
42nd	„	1.5		18.2	225	40.7	155
43rd	„	2.4		19.3	239	34.0	130
44th	November	2.3	140	18.1	224	42.0	160
45th	„	2.9		15.1	187	33.6	128
46th	„	3.6		13.6	168	36.0	137
47th	„	2.4		12.6	156	38.7	148
48th	December	2.5	135	12.9	160	30.0	115
49th	„	3.2		11.7	145	32.2	123
50th	„	2.8		10.4	129	34.3	131
51st	„	2.6		7.5	93	27.3	104
52nd	„	2.4		7.1	88	24.0	92
Mean	.....	2.0	100	8.1	100	26.2	100

TABLE V.—*Average weekly deaths in London, and percentage of the Mean.*

		SIX YEARS, 1869-74.						TEN YEARS, 1875-1884.					
		Typhus Fever.		Enteric Fever.		Simple continued.		Typhus Fever.		Enteric Fever.		Simple continued.	
Week.	Month.	Average.	Percent. of Mean.	Average.	Percent. of Mean.	Average.	Percent. of Mean.	Average.	Percent. of Mean.	Average.	Percent. of Mean.	Average.	Percent. of Mean.
1st	Jan.	9.5	125	18.0	102	10.7	122	1.7		18.8	110	4.0	
2nd	„	10.7	141	17.8	101	11.0	125	2.6	112	17.2	101	4.1	121
3rd	„	8.5	112	17.5	99	8.8	100	1.9		16.2	95	3.2	
4th	„	9.7	128	17.5	99	7.7	88	2.0		17.6	103	3.5	
5th	Feb.	7.7	101	17.3	98	9.7	110	2.1		14.8	87	3.0	
6th	„	8.3	109	17.5	99	9.7	110	2.0	102	15.5	91	2.3	92
7th	„	10.3	136	21.2	120	8.8	100	2.1		16.6	97	3.8	
8th	„	9.7	128	16.0	91	13.2	150	1.3		14.1	83	2.5	
9th	Mar.	7.0	92	15.0	85	8.3	94	1.7		13.2	77	3.0	
10th	„	6.7	88	17.7	101	9 3	106	2.4		15.0	88	2.9	
11th	„	8.8	117	15.2	86	10.5	119	2.5	107	16.4	96	4 0	102
12th	„	9.0	119	18.0	102	9.0	102	1.8		15.9	93	2.5	
13th	„	7.8	103	16.0	91	9.0	102	1.7		16.5	97	3.4	
14th	April	7.0	92	15.5	88	8.8	100	2.1		14.1	83	4.0	
15th	„	8.2	108	14.5	82	7.7	88	1.7	112	16.3	96	2.4	108
16th	„	10.3	136	15.0	85	8.0	91	2.0		12.1	71	4.0	
17th	„	8.8	116	14.2	81	8.5	97	2.6		13.1	77	2.9	
18th	May	7.5	99	13.2	75	8.7	99	2.9		12.3	72	3.5	
19th	„	8.0	105	13.0	74	7.2	82	1.2	96	10.8	63	2.3	108
20th	„	6.3	83	13.5	77	8.5	97	1.9		11.4	67	3.8	
21st	„	7.2	94	11.8	67	8.2	93	1.0		13.3	78	3 8	
22nd	June	7.0	92	14.5	82	9.5	108	2.7		11.2	66	2.5	
23rd	„	6.7	88	14.2	81	9.8	111	1.5		12.1	71	3.2	
24th	„	6.8	89	14.5	82	8.8	100	1.5	102	12.0	70	2.5	92
25th	„	5.2	68	12.8	73	8.0	91	2.0		10.5	62	2.8	
26th	„	6.5	86	12.3	70	6.7	76	2.0		11.6	68	3.2	
27th	July	7.5	99	12.8	73	7.3	83	2.0		11.8	69	2.6	
28th	„	9.8	130	13.8	78	7.2	82	1.1	80	13.2	77	4.1	102
29th	„	5.7	75	15.7	89	9.2	105	1.7		12.3	72	2.5	
30th	„	8.5	112	14.2	81	8.2	93	1.0		14.6	86	3.2	
31st	Aug.	7.0	92	17.0	97	7.0	80	1.5		11.3	66	2.7	
32nd	„	7.2	95	14.5	82	7.0	80	1.2	70	15.2	89	2.6	95
33rd	„	7.2	95	20.8	118	6.2	70	1.2		15.3	90	3.8	
34th	„	4.2	55	19.2	109	7.3	83	1.1		14.5	85	2.6	
35th	Sept.	6.0	79	22.3	126	6.7	76	2.0		15.5	91	2.7	
36th	„	6.3	83	16.5	94	9.2	105	1.3		16.9	99	3.5	
37th	„	6.0	79	19.3	110	10.7	122	2.0	96	20.1	118	2.2	86
38th	„	6.3	83	19.5	111	8.8	100	1.9		22.4	131	2.3	
39th	„	6.2	82	20.1	118	9.3	103	1.8		21.9	128	2.9	
40th	Oct.	9.7	128	20.7	118	8.0	91	2.2		24.6	144	2 8	
41st	„	8.8	116	20.3	115	9.8	111	1.8	107	25.3	148	3.5	105
42nd	„	7.7	101	19.5	111	6.5	74	2.1		26.8	157	3.7	
43rd	„	5.5	72	27.5	151	7.7	88	1.7		26.3	154	2.9	
44th	Nov.	7.5	99	23.2	132	9.0	102	1.8		27.2	160	3.6	
45th	„	7.2	95	22.0	125	8.8	100	2.1	128	27.0	158	3.2	95
46th	„	8.6	113	24.8	141	8.0	91	2.9		25.4	149	2.1	
47th	„	6.0	79	24.0	136	9.5	108	2.6		25.0	147	3.1	
48th	Dec.	9.2	121	20.5	117	9 8	111	2.1		25.7	151	4.0	
49th	„	6.8	89	23.8	135	11.5	130	1.8		21.6	127	3 3	
50th	„	6.0	79	22.1	125	9.8	111	1.8	102	20.1	118	3.2	105
51st	„	7.0	92	21.7	123	9.7	110	2.2		21.1	124	3.0	
52nd	„	6.7	88	20.0	114	10.0	114	1.8		16.8	99	3.1	
	Mean	7.6	100	17.6	100	8.8	100	1.9	...	17.1	100	3.2	

TABLE VI.

Average weekly deaths from Scarlatina in London during the ten years, 1875–1884.

Week.	Month.	Average Deaths.	Percentage of Mean.	Week.	Month.	Average Deaths.	Percentage of Mean.
1st ...	January ...	45.7	105	27th ...	July	36.1	83
2nd...	,, ...	48.3	111	28th ...	,, ...	44.3	102
3rd ...	,, ...	47.0	108	29th ...	,, ...	39.9	92
4th ...	,, ...	46.1	106	30th ...	,, ...	46.5	107
5th ...	February ...	39.3	90	31st ...	August	40.8	94
6th ...	,, ...	35.4	81	32nd...	,, ...	46.2	106
7th ...	,, ...	32.8	75	33rd ...	,, ...	39.5	91
8th ...	,, ...	33.8	78	34th ...	,, ...	46.0	106
9th ...	March	31.4	72	35th ...	September .	44.7	103
10th ...	,, ...	29.7	68	36th ...	,, ...	42.0	97
11th ...	,, ...	27.4	63	37th ...	,, ...	43.6	100
12th ...	,, ...	28.2	65	38th ...	,, ...	48.2	111
13th ...	,, ...	31.7	73	39th ...	,, ...	56.3	130
14th ...	April.....	26.8	62	40th ...	October ...	57.8	133
15th ...	,, ...	26.8	62	41st ...	,, ...	61.5	142
16th ...	,, ...	29.8	69	42nd...	,, ...	66.0	152
17th ...	,, ...	27.7	64	43rd ..	,, ...	67.5	155
18th ...	May	33.6	77	44th ...	November .	68.3	157
19th ...	,, ...	31.2	72	45th ...	,, ...	67.1	154
20th ...	,, ...	29.1	67	46th ...	,, ...	65.4	151
21st ...	,, ...	33.0	76	47th ..	,, ...	64.8	149
22nd...	June..	35.0	81	48th ...	December...	63.0	145
23rd ...	,, ...	33.6	77	49th ...	,, ...	57.4	132
24th ...	,, ...	34.0	78	50th ...	,, ...	58.9	136
25th ...	,, ...	34.9	80	51st ...	,, ...	51.9	119
26th ...	,, ...	34.9	80	52nd...	,, ...	48.4	111
				Mean...	...	43.5	100

TABLE VII.

Deaths from Enteric Fever, Typhus, and Scarlet Fever in London, 1875–1884.

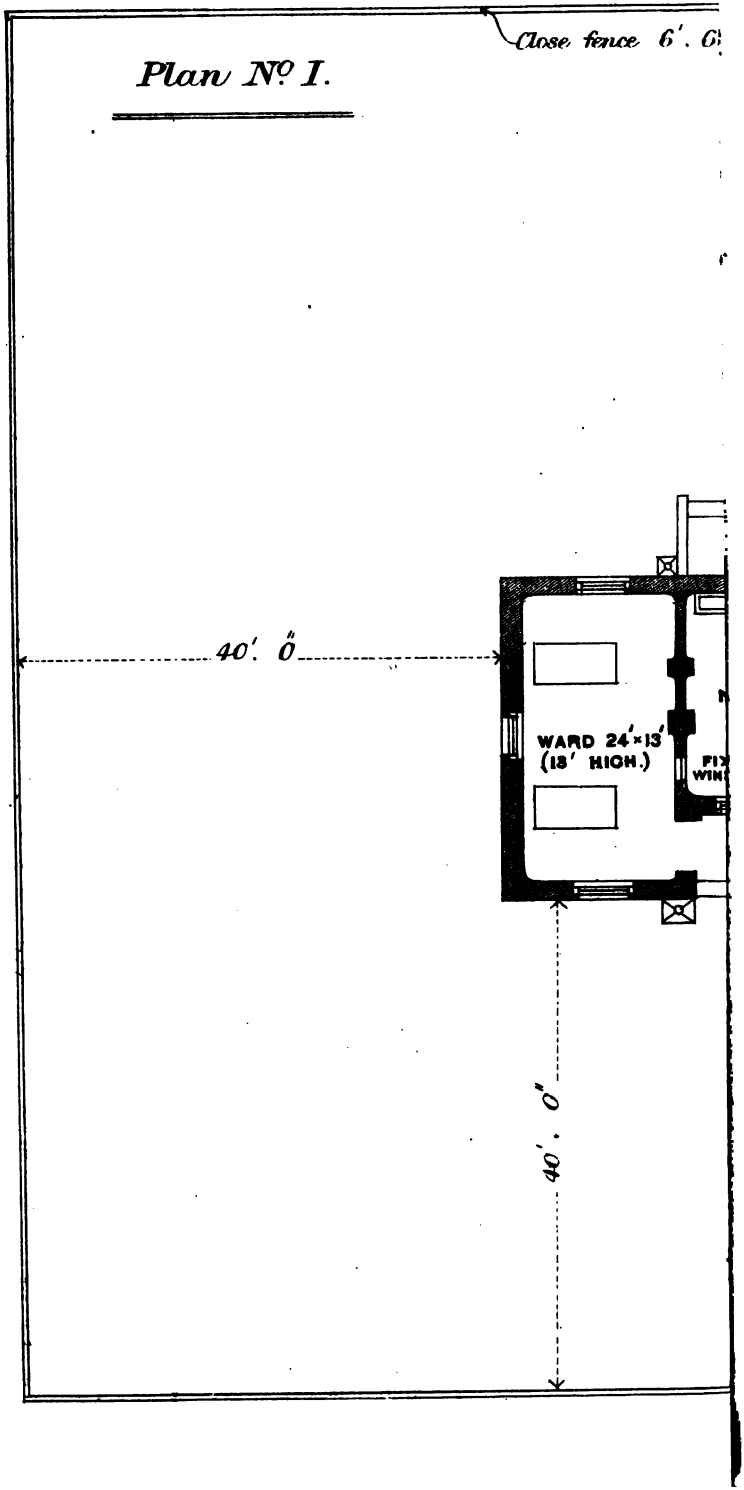
Years.	Total Deaths in London.				Deaths in Metropolitan District Asylums Board Hospitals.				Percentage of Deaths in Board Hospitals to Total Deaths.			
	Enteric Fever.	Typhus.	Scarlet Fever.	Total.	Enteric Fever.	Typhus.	Scarlet Fever.	Total.	Enteric Fever.	Typhus.	Scarlet Fever.	Total.
1875	817	128	3,677	4,622	74	15	151	240	9.1	11.7	4.1	5.2
1876	769	159	2,308	3,236	56	28	86	170	7.2	17.6	3.7	5.3
1877	901	157	1,580	2,638	80	36	55	171	8.9	22.9	3.5	6.5
1878	1,033	151	1,808	2,992	95	47	90	232	9.2	31.1	5.0	7.8
1879	819	71	2,661	3,551	83	11	214	308	10.1	15.5	8.0	8.7
1880	702	74	3,100	3,876	41	5	241	287	5.8	6.8	7.8	7.4
1881	971	92	2,114	3,177	87	34	169	290	9.0	37.0	8.0	9.1
1882	975	53	2,006	3,034	106	26	187	319	10.9	49.1	9.3	10.5
1883	963	55	2,006	3,024	80	10	228	318	8.3	18.2	11.4	10.5
1884	936	31	1,444	2,411	106	6	237	349	11.3	19.4	16.4	14.5
Ten years, 1875-84	8,886	971	22,704	32,561	808	218	1,658	2,684	9.1	22.5	7.3	8.2

TABLE VIII.

Year.	TYPHUS.			ENTERIC FEVER.			SCARLET FEVER.		
	Admissions to Metropolitan Asylums Board's Hospitals.	Deaths in London.	Deaths to 100 Admissions.	Admissions to Metropolitan Asylums Board's Hospitals.	Deaths in London.	Deaths to 100 Admissions.	Admissions to Metropolitan Asylums Board's Hospitals.	Deaths in London.	Deaths to 100 Admissions.
1875	64	128	200	302	842	279	1,142	3,651	320
1876	128	163	127	287	781	272	667	2,297	344
1877	173	159	92	393	886	225	500	1,576	315
1878	178	150	84	493	1,010	205	685	1,792	262
1879	51	70	137	436	861	197	1,482	2,706	183
1880	28	72	257	278	689	248	1,958	3,073	157
1881	214	96	45	444	977	220	1,488	2,108	142
1882	141	52	37	552	975	177	1,948	2,004	103
1883	37	56	151	518	935	181	1,950	1,989	102
1884	30	31	103	524	925	177	1,867	1,416	76

SKETCH

SUITABL



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TABL
6'. 6

ON SOME SPECIAL ARRANGEMENTS FOR THE ISOLATION OF INFECTIOUS DISEASES.

By R. THORNE THORNE, M.B., F.R.C.P.

(*Read: April 8th*, 1885.)

A PAPER by Mr. P. Gordon Smith, F.R.I.B.A., architect to the Local Government Board, on the "Planning and Construction of Hospitals for Infectious Diseases," was read before the Society during the session 1882-83, and is published in vol. ii of the New Series of the Society's *Transactions*. This paper has been found to be of considerable use to sanitary authorities and others, and it has occurred to me that it might be desirable to supplement it by bringing under the notice of the Society plans of two modified forms of buildings for the isolation of infectious diseases, which have just been issued by the Local Government Board.

It has very generally been held that the smallest amount of permanent accommodation which any sanitary authority ought to possess, should suffice for the simultaneous isolation of initial cases of two different infectious diseases, and that, under ordinary circumstances, the provision should reach one bed per thousand inhabitants. The former of these two conditions has very commonly been met by the erection of two separate ward-pavilions, each containing a male and a female ward. But where the population of a district is small, the provision of this accommodation would often necessitate the erection of buildings containing more beds than are necessary for the ordinary wants of the place, and would involve an expenditure of money which might be prohibitory. Such a case came before the Local Government Board some short time since, when an isolation hospital was needed for a stationary population of about 4,000 people. The authority were willing to provide four beds, but for reasons of economy it was considered that they should all be under one roof. The question then arose as to how these beds should be arranged in order to facilitate to the utmost the safe reception into the hospital of at least two different specific fevers, and at the same time to make some provision for the separation of sexes.

Plan No. I, which has been prepared jointly by the Medical and Architectural Departments of the Board, is believed to effect these objects in the most satisfactory manner available under the circumstances. The hospital pavilion, as shown in the plan, is divided into four rooms, two for patients, and two for nurses; there is also a detached administrative or caretaker's cottage, and a small group of outbuildings. The special arrangements indicated are as follows:—

1. No building intended to receive infected persons or things is allowed to stand at a less distance than 40 feet from the wall, or close fence, which constitutes the boundary of the site.

2. The external walls of the buildings are at least 14 inches thick; a condition which is essential in the case of the wards in which it is most necessary to aim at maintaining an equable temperature.

3. The four rooms open, under one or other of two verandahs, directly into the outer air. There is thus no aërial communication between any of them.

4. All angles, horizontal as well as vertical, are rounded off so as to prevent the deposit of infectious dust, etc., and to facilitate thorough cleansing of the ward-rooms.

5. One set of two rooms, *i.e.*, a two-bedded ward, and the nurse's room belonging to it, open into the verandah to the front; the corresponding set of rooms open into another verandah at the back. This arrangement tends to the more complete separation of two different diseases.

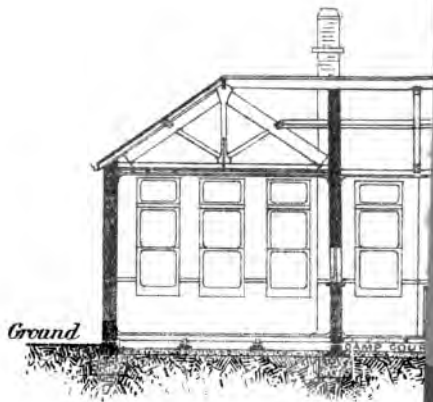
6. A railing fixed across the verandah is intended to hinder communication between the occupants of the two halves of the building.

7. The beds are so placed in each of the ward-rooms, as to secure to each patient the full requisite amount of ward-space, *i.e.*, at least 2,000 cubic feet, 12 feet of wall-space, and some 150 feet of floor-space. The width of the ward being 13 feet, allows the bed to stand at least one foot from the wall, an arrangement facilitating the circulation of air about the patient. Any height of ward above 13 feet should not be taken into account in reckoning the cubic space per patient.

8. Movable baths and earth commodes will be required for the wards.

9. Where nurses' bedrooms are not provided in the caretaker's cottage, they may be placed in an upper story of the ward-block, as shown in the elevation. This upper story is reached by a staircase occupying the centre of the building,

Plan No II.


Ground
DAMP COURSE

½

SINK
WARD 36.0×18.0×13.0
NURSE
FIXED INSPECTION WINDOW

and opening into one of the verandahs. In this way the nurses' bedrooms are kept free from ward-air.

Plan No. II is designed on the same principles as those referred to in connection with No. I, but the building is on a larger and more useful scale. It contains ten beds, which are divided into two groups of five, each group occupying two small wards separated by a nurse's room; and the more complete separation of different infections is provided for by the arrangement which requires the doors of each group of rooms to open into a separate verandah. In this plan a W. C. and a ward-sink have been provided for each group of rooms. In order that they might serve both ward-rooms, it has been necessary so to arrange them that they shall be approached by means of the verandah; and since there will be occasions when the sick should not risk exposure to the outer air, this arrangement will necessitate the provision, behind a screen in each ward-room, of an earth or other commode, to be emptied immediately after each use. The baths, being movable, will also be used in the wards; and if it should be preferred, the nurses' rooms could be recessed, so that each bath might stand in the recess thus formed alongside the verandah. By this arrangement the central compartments shown for the baths may be avoided, the supply of hot-water to each bath will be more directly laid on from the boiler in the nurse's room, and one drain-connection will suffice for the nurse's sink, and for the sink over which the bath may be emptied.

The special value of this ten-bedded pavilion is that it will serve either as an isolation pavilion in a hospital of more than one block, or as the total accommodation for a district the permanent needs of which do not call for more than some ten beds. In a large number of districts it is the immediate isolation of one or two cases of infectious diseases, or of doubtful cases, that is far more wanted than means for the reception of larger numbers; and the plan now advocated supplies that special want, whilst at the same time it provides a total of ten beds for either one or two diseases, as also private accommodation for persons willing to pay for it.

No sleeping accommodation for nurses is shown in this second plan, because it is assumed that the staff necessary to the supervision, maintenance, and care of ten patients by day and by night must involve the provision of a small administrative cottage, as well as certain indispensable accessories.

VARIOLA AND THE VARIOLOID DISEASES OF ANIMALS.

By E. F. WILLOUGHBY, M.B.

(*Read: May 13th*, 1885.)

The greater number of diseases, that is those pathological states dependent on deviations from the normal processes of nutrition and innervation, resulting in the conditions known as atrophy, degeneration, inflammation, etc., are common, more or less, to all animals, and in the higher grades, or warm-blooded animals, exhibit essentially the same phenomena.

It is somewhat different with what are called specific diseases; that is, certain sequences of morbid phenomena following the entrance into the organism of specific poisons or virus, which may in some cases be purely chemical bodies, but which have been proved in many, and may by analogy be assumed in more, to be of a parasitic nature, that is, micro-organisms capable of multiplication in, if not of perpetuation also out of, the body, and directly by their presence, or indirectly by the action of substances generated by them in the animal fluids, setting up changes in the blood and tissues. Some of these, as the bacilli of tuberculosis, and of several forms of septicæmia, are capable of infecting many different classes of animals, and producing in all results essentially identical, any apparent differences being easily explicable by differences of histological characters. Others are peculiar to single genera or species of animals, and either totally incommunicable to others or communicable only by direct inoculation, and then setting up phenomena for the most part strictly local and otherwise distinguishable from those of the normal form. The most typical examples of these diseases are to be found in the pustular eruptive fevers of man and beast, the mutual relations of which I propose discussing in this paper. Before advancing any theories, whether of my own or others, I shall simply state certain observed facts.

Man is subject to an acute specific pustular exanthem known as variola or small-pox, highly infectious, pyrexial

and fatal, having a constant incubation period of about thirteen days when communicated by aerial infection and by fomites, but when by inoculation, presenting certain deviations from its normal type. It is not communicable to other animals, monkeys excepted, by ordinary infection, and with great difficulty by inoculation to the ox, when it presents the character of a local affection only.

Sheep have a variola closely resembling that of man in every respect, but clearly an independent disease, being enzootic where small-pox is almost unknown, as in East Prussia, and unknown except when imported where, as in England, small-pox is never absent. Inoculation of ovine variola produces in the sheep the same modified type of disease, and similar immunity from ordinary infection as that of small-pox does in man. Inoculated in the horse, and ox, and man, it produces only a local affection, but it appears to be communicable in a less modified form to the more closely allied goat.

Goats, however, have, it appears, their own variola, for in Norway, where they are numerous, it is rarely absent, yet sheep-pox is unknown. It is seldom seen in countries where goats are kept in less numbers.

Camels have a variola, which is not unfrequently communicated to man in a severe form. It does not, however, seem to be as fatal to these animals as sheep-pox is to the sheep.

Swine have their variola, a highly infectious and fatal disease, and communicable by inoculation to the sheep, goat, and man, though experiments on the ox and the horse have as yet given only negative results.

Dogs have a variola of their own, very fatal to young puppies, contagious and inoculable, but not very infectious. It is somewhat remarkable that they do not seem ever to contract variola from man, considering how much they are associated with him. Greve has, however, succeeded in inoculating dogs with human small-pox; but it may be said that dogs are by no means susceptible to inoculation with the variola of other animals, or indeed, as recent experiments with the tubercle bacillus have strikingly shown, are they to any forms of infectious or infective disease.

Variola of fowls and of some other animals have been described; but I forbear from enumerating more than those already mentioned. It is unfortunate that, as everyone must have felt in reading even the more pretentious works on veterinary medicine, the standard of pathological knowledge among the medical attendants of our domestic animals

is still very low, while among ordinary agriculturists we can still less look for anything like accurate scientific observation, or the capability of distinguishing between a specific pustular exanthem and a non-specific cutaneous disease as herpes, attended by vesicular eruptions and scabbing.

All the diseases we have thus far considered have the same characters of general eruption, high fever, and high mortality, as well as infectiousness by ordinary intercourse, and by fomites, within the species to which each properly belongs, and may therefore be fairly considered as so many species of the genus variola, and be called variola humana, ovina, caprina, camelina, porcina, and canina. I waive the question of a common origin in the remote past, and am content to admit that, as I am inclined to believe has been the case with certain allied, but now distinct, specific diseases incident to mankind, they have become so differentiated as to be properly described as separate and independent diseases.

They are, however, all more or less easily communicated to other animals, man included, by direct inoculation, when they appear variously modified, more or less localised, and far less severe or fatal than in their original form. And the same holds good, though in a less degree, of the disease produced by inoculation of the virus into animals of the same species, that is, the inoculation of man and other animals with their own proper variolæ.

Cow-pox and horse-pox differ in several essential features from the true variolæ. They have, like them, a definite period of incubation, followed by some febrile disturbance and an eruption passing through the successive stages of papules, vesicle, perhaps pustule, and scab. But so far as we know, they are communicable by direct contact or inoculation only, and not by ordinary infection, any evidence to the contrary or of their supposed spontaneous origin, if indeed a variola of any kind can so arise, being wholly negative, or at best circumstantial. They are, too, unlike the true variolæ, unattended, at any rate in their normal course, and in the absence of erysipelatous or other septic complication, by any severe febrile disturbance or any danger to life, and they are confined to a limited part of the surface of the body. In short, they are non-infectious, not dangerous and strictly local affections, standing in the same relation to the others as vaccination does to small-pox in the human species. The horse-pox is distinguished by the large size of the vesicles, those of cow-pox bearing a closer resemblance to the vaccinal eruption in man.

Inoculable in any part of the body of animals of either

sex, and of every age, those cases which are not the result of intentional inoculation, the so-called spontaneous cases, are almost invariably confined to the heels and lower part of the leg in the horse, and to the udders of milch cows, and the lips of sucking calves. They are communicable by inoculation, intentional or accidental, to man and other animals, and when so acquired, confer for a considerable time immunity more or less complete against the effects of subsequent inoculations of the kind, and of those of exposure to an inoculation with the virus of human small-pox, though they do not seem to afford a like protection to sheep or other animals against attacks of their own respective variolæ.

These are the bare facts of the case, concerning which there is a general unanimity; but on these, two strongly opposed theories have been built. Before I proceed to enunciate these theories, I must state one more fact, viz., that inoculation of the bovine race with human variola is a matter of extreme difficulty, and success when achieved is only partial, the sole result being a hard papule, with or without the development of an insignificant vesicle, lasting perhaps but a few hours, quite different from the well-marked vesicle of ordinary so-called cow-pox.

Of the two theories as to the mutual relations of the several variolæ, or it would be more correct to say the relations of horse-pox and cow-pox to the others, especially to that of man, one I shall call for the sake of convenience the French theory, since though it has found a few adherents in other countries, as Professor Bollinger in Germany, and Mr. G. Fleming in England, it is the accepted doctrine in France, where MM. Chauveau and Bouley are among its most prominent advocates. According to this view, there are two orders of variolæ, one including all that I have called true variolæ, infectious, attended by great constitutional disturbances, general eruption, and serious danger to life; and another, comprising only the equine and bovine, requiring actual contact for communication, with little constitutional disturbance, localised or partial eruption, and no danger to life. In the one, to use Mr. Fleming's expression, the virus is "volatile", in the other it is fixed. But they ask us to believe what, if their theory be sound, is an indisputable fact, paradoxical as it appears, viz., that while there is no evidence whatever that inoculation of any one of the first order or true variolæ into the bodies of animals other than those whose own variola it is, affords any protection against infection with their own, the inoculation of either of those of the second order confers, in the case, at least, of man, as great

immunity against his variola as the inoculation of small-pox itself. Or, to put it in other words, small-pox and sheep-pox have every feature in common, while cow-pox is essentially a different disease. Inoculation of small-pox protects a man against small-pox infection, and inoculation of sheep-pox protects a sheep against sheep-pox infection. But inoculation of sheep-pox does not protect a man against small-pox, a very similar disease, though inoculation with cow-pox, a very unlike one, does, and it protects the cow equally against both its own and the human form of the disease.

The other theory, and that which I am convinced is the correct one, is that, while setting aside all questions of the evolution of diseases in times anterior to experience, the true variolæ are so many distinct and specific diseases peculiar to the respective animals, though capable of being communicated in a modified form by inoculation to other species; cow-pox and horse-pox are not independent and specific affections, but merely two particular instances of this modification by the cultivation of the virus of human small-pox in the organism of an animal to whom this form of variola is not natural. If we admit this view, the law of immunity becomes at once clear and consistent, and may be expressed by four theses:—

(1) One attack of variola of the kind proper to any animal protects the individual against subsequent infection by, or inoculation of, the same.

(2) Inoculation of any animal with the virus of its own variola produces a milder form of the same disease, but affords a protection similar to that conferred by an attack acquired by ordinary infection.

(3) Any variola inoculated in an animal other than that whose proper variola it is, gives rise to a peculiarly modified form of the disease, attended by little constitutional disturbance, merely local eruption, and no danger to life; such modified disease being no longer communicable to any other animal of the same or of different species, except by direct inoculation; and

(4) This modified disease affords a considerable degree of immunity against infection by any means whatever with the variola whence it was derived, either to the animal whose variola was the original source of it, or to others capable of being infected in any way thereby.

Jenner suggested the original identity of small-pox and the diseases incident to the horse and the cow, but did not attempt to prove it experimentally. He merely maintained,

from numerous observations given in detail in his classical work, that cow-pox was identical with, and derived from, what he called "grease" in horses; being communicated to the cows by the hands of men who milked them after having dressed the heels of diseased horses, supporting his view by positive evidence, as well as by the fact that in Ireland, where men were never employed in milking, cow-pox was almost, if not quite, unknown. Gassner and Sondermann, in the early part of the present century; Thiele and Ceeley between the years 1830 and 1840, and, more recently, Reiter, Badcock, Senft, and, last but not least, Voigt, to whose experiments I shall refer more particularly, all believed that they had succeeded in inoculating the cow with small-pox, and in producing by that means a cow-pox indistinguishable from the so-called spontaneous disease. Doubts have been cast on the correctness of the conclusions of some of these observers, but there is no denying the fact that Ceeley's lymph thus obtained was extensively employed by Schneemann, of Hanover, for the vaccination of many hundreds of children, and found by him to be identical in every respect with good humanised lymph.

In 1860, Dr. Martin, of Boston, in America, attempted to repeat Ceeley's experiments, but with the unfortunate result of setting up an epidemic of small-pox, and causing several deaths: a like disastrous experience befel an Indian surgeon; and for many years these examples deterred others from further experimentation in this direction.

The explanation put forward by the French school, and accepted by its adherents abroad, of these conflicting experiences of Ceeley and Martin is that small-pox inoculated into the cow, while producing an apparently trifling local effect, the papular, already described, undergoes no modification, or, as they would say, attenuation; that Ceeley's supposed vaccinations were really examples of mild and favourable inoculations, and Martin's of severe and fatal ones; the only difference being that Ceeley selected, as the source of his virus, favourable cases of small-pox, while Martin, as we know, took his from a virulent case, and actually after death. They maintain that cow-pox is a disease *sui generis*, and that though the local phenomena following successful inoculation of small-pox in the cow are so unlike those which follow the same operation in the human subject, the lymph yielded by the resultant vesicle has undergone no change or mitigation, and is still unmodified small-pox. But such assumption gives the lie direct to the sober statements of honest and cautious observers, and is totally irreconcilable with the successful

transmission of Ceeley's lymph through a long, and, perhaps, still unended, succession of Hanoverian infants. If Ceeley were mistaken in a few instances, Schneemann could not have been in hundreds. That Ceeley did what he believed he did, has been, as I shall soon show, conclusively demonstrated by Voigt, and the true explanation of Martin's misfortune is that he failed to do the same. He did not succeed in infecting his cow at all; he put in variolous pus, and after producing maybe some local irritation, he took it out again, and inoculated his patients with the worst type of small-pox, as directly as if his lancet had never touched the animal. The difficulty of inoculating the cow with small-pox is so great that Ceeley did not succeed until after numerous failures; and Reiter failed in fifty trials, extending, with characteristic German pertinacity, over ten years, when, in the fifty-first, he succeeded not only in inoculating the animal operated on, but also in accidentally communicating the disease to two others in the same stall, obtaining from these latter a lymph with which he successfully vaccinated a number of persons. We need not be surprised that Frenchmen, wanting in such perseverance, and either failing in the attempt or leaving the work unfinished, should, *more Gallico*, prefer to discredit or ignore the evidence of Englishmen and Germans rather than allow the honour to a foreigner; but that, on no better evidence than the conclusions of the said Frenchmen, Englishmen should do the same, is strange.

In the year 1881, Leonhard Voigt, Director of the Vaccine Institute at Hamburg, resolved to investigate the entire question afresh. Though not personally doubting the correctness of Thiele's facts, he felt that his observations were somewhat wanting in scientific accuracy and precaution; but he was unwilling to believe, with Chauveau and his admirers, that Ceeley and Badcock, Senft and Reiter, were deluded or dishonest, or were, as the Frenchmen would have it, both fools and knaves; and he has achieved triumphant success, vindicating the reputation of our immortal Jenner, and demonstrating beyond the possibility of dispute the conversion of typical variolous pus into a vaccine lymph of the utmost purity. Taking the virus from the pustules of a confluent small-pox in an unvaccinated girl, he inoculated with it four cows in succession. In the first three attempts he attained but partial success, the inoculations ending abortively—that is, producing papules, but yielding no lymph. The fourth was more fortunate, a small vesicle appearing for a few hours. This he secured, and chose as a *corpus vile* an ill-nourished child, under treatment in the hospital for

itch, but being unvaccinated, in imminent danger from the appearance of small-pox in the same ward. The result was what he had apprehended; intense febrile disturbance, axillary bubo on the side of the vaccinated arm, eczema, and some half dozen discrete nodules leading to fluctuating tubercles, though no truly variolous eruption. Happily for both parties, the child survived. Meanwhile, Dr. Voigt continued his inoculations of the calves with lymph taken from one to another through fifteen successive generations—in fact, carrying out Pasteur's idea of attenuation by successive cultivations, and with steadily increasing facility, the vesicles obtained rapidly assuming the appearance characteristic of so-called genuine cow-pox. The lymph of the second cultivation he did not venture to use. With that of the third he vaccinated four children, one twice without result, the other three successfully. The fever ran unpleasantly high, and the axillary glands were enlarged, but there was nothing abnormal in the vaccinations. It is true they suffered respectively from erysipelas, tonsillitis, and pneumonia—mere accidents, which he attributed to the unusual severity of the weather, and the insanitary conditions of their homes. He did not attempt further experiments until he had reached the eighth cultivation. This gave entirely satisfactory results, and an intercurrent eruption of measles subsided in two days. The lymph of the ninth and subsequent cultivations was employed without hesitation by the other surgeons of the Institute in their ordinary vaccinations, the appearances presented by the animals and by the children vaccinated from them being undistinguishable from those produced by the best Beaugency or other animal lymph from accredited sources.

Evidence more conclusive it is impossible to conceive or desire, and even if all former alleged successes be rejected as uncertain or unproven, Voigt's results must convince anyone not absolutely blinded by prejudice. According to Voigt, then, every case of alleged spontaneous cow-pox is either one of accidental variolation or retro-vaccination of the cow. In pre-vaccination times, when small-pox was everywhere present, the numerous opportunities for variolation made up for the difficulty of thus inoculating the cow, or we may suppose that the horse was more susceptible, and, as Jenner held, the cow was infected from the horse. Now-a-days, retro-vaccination, which is notoriously easy, is the rule, mothers proceeding to milk the cows after attending to their recently vaccinated infants. We do not believe that small-pox ever originates *de novo* in the human being, or otherwise than by infection or inoculation of some kind; though, amid

the ceaseless movements of a population and exchange of possible fomites, it is often difficult or impossible to trace the actual source of infection. If cow-pox arise spontaneously, as I admit it must do were we to reject Voigt's explanation, the fact would remove it still further from the variolæ; and if it be as remote from human as from ovine variola, why is it protective against the one and not against the other?

The direct inoculation of the cow with human variola is, as I have said, a matter of extreme difficulty, and the only result obtained in the event of success is a papule which more often than not fails to lead to a vesicle or to contain any fluid; but if it do, and the minute quantity of lymph be secured, and used again, each succeeding inoculation is easier than the preceding, and the resulting vesicles assume in the third or fourth term of the series the appearance of those of so-called spontaneous cow-pox, *i.e.*, of cases of unknown origin. Once more, I repeat that though the French may choose to set aside as "abortive" the blind papule, or at best, rudimentary and imperfectly developed vesicle I have described, it is the normal characteristic and constant result of successful variolation of the cow, and that it is idle to look in such cases for a well-marked vesicle such as we get in retro-vaccination.

Now the position assumed by M. Chauveau, and accepted by those who agree with him, is simply this. Because a few Frenchmen, in a few experiments undertaken with a view to confirm a pre-conceived opinion and foregone conclusion, have either failed in an attempt which is notoriously difficult of achievement, or, having succeeded, have obtained just the result that they were told beforehand they might, and not that which they had no right to expect, and being thus proved wrong by the evidence of their own experiments, have resolutely refused to proceed further, and to verify or refute the doctrine of their opponents, they flatly deny that others in England and Germany have done what they themselves have not even attempted to do. They ask us to believe that Ceely, Badcock, Senft, Thiele, and Reiter did not, as they believed they did, transmute variolous into vaccine lymph by passing it through the bovine organism; that these observers were so ignorant or so prejudiced as not to see that their vaccinations were really cases of inoculated small-pox; that not only were they deceived in a few instances, but that Schneemann and others were, in hundreds, practising inoculation of small-pox on infants for years without discovering it or its being discovered; or what if less charitable would be more reasonable, that Ceely, for example, palmed a different

lymph on Schneemann from what he stated. As to Voigt's brilliant performance, they, so far as I have read, ignore it, maintaining a discreet silence.

But from a pathological point of view their doctrine leads us into hopeless confusion, involving what Augustus de Morgan would have called a veritable "bundle of paradoxes". We are asked to believe that while the variolæ proper, a well-marked and closely allied group of diseases, are not mutually protective, two, which, as they admit, differ in every circumstance of origin, symptoms, course, and mode of communication from the true variolæ, are protective against not all, but one only of the other group, and that though they exactly resemble the local manifestation produced by the inoculation of true variolæ on other animals than those to which they properly belong, the resemblance is illusory, and they really have nothing in common; but we are told that though the "bouton abortif", the mostly dry papule which follows successful variolation, appears so unlike the small-pox pustule, the matter it contains, if it contains any at all, is unaltered, unmitigated small-pox virus which, contrary to all analogy, undergoes no attenuation by cultivation, even in the most diverse soil. But I forbear to pursue further the exposure of these fallacies. Voigt's facts are irrefragable. Either Chauveau and Co. are too prejudiced by national jealousy to be impartial, or Voigt is the last and most mendacious of a succession of impostors! *Credat Gallus non Ego!*

One word, in passing, on horse-pox. I have said that it is equally protective with cow-pox against small-pox, being, like it, merely a modification of that disease obtained by transmission through the organism of another animal; but both in the horse, and when communicated to man, the local symptoms are more severe, and the vesicles so very much larger than those of cow-pox, that it cannot be recommended for the purpose.

But the matter is one of the highest importance in its bearings on the present and future practice of vaccination. Two questions are frequently presented to us, one of which again involves two others. The first is, have we any reason to fear that humanised lymph has undergone any enfeeblement in its passage through many thousands of infants, and, if so, can we revivify it by passing it once more through the calf, or shall we from time to time seek a fresh and virgin supply in what certain persons allege to be spontaneous cases of cow-pox? The second question is, whether in view of the possible communication of syphilis by the use of lymph from the human subject we may not avert the danger, or

satisfy the scruples of those who object to vaccination on this ground, by passing it through the body of an animal insusceptible of syphilisation? To this last question, apart from all consideration of the relative activity of the vaccine lymph as such, I answer unhesitatingly, "Yes".

The first question is a more complex one. I believe that there is no trustworthy evidence that, so long as humanised lymph is taken from selected and well-marked typical cases, with every precaution known to vaccinators for ensuring its freedom from syphilitic or septic or erysipelatous contamination, or from deterioration in storage, its efficacy undergoes the least diminution by cultivation in the human organism.

On the other hand, the experiments of Voigt show that for a certain number of generations it does tend to attenuation in the foreign soil of the bovine organism, at least when developed immediately from variola humana; but whether, as Voigt thinks, this attenuation is progressive, is a question still *sub judice*. Is it revivified by a single re-transmission through the calf, as the Frenchmen assert? I trow not. Indeed, holding the views of its origin that I do, I can see no conceivable reason for supposing that it should be. The instructions issued with the calf-lymph supplied by the Local Government Board, state that it does not take so readily as human lymph, though I myself have never failed in a single insertion, in my limited experience of it. Some persons, on the other hand, maintain that the use of what they call genuine cow-pox, that is, cases of unknown origin, is attended by constitutional and local disturbance far greater than that which follows vaccination either with humanised lymph, or with the product of retro-vaccination of the calf, or vaccination of the calf from an infant. Such experiences admit of two explanations; it is possible that, as Voigt suggests, some cases of spontaneous cow-pox, so-called, may be really variolation, and others retro-vaccination, either infection being effected unawares. The former, as he found in the case of the unfortunate child with the itch, are fraught with the greatest danger, several cultivations being necessary to render such lymph mild enough to be used with safety; but it is also highly probable that the development of the vesicles in the calf being less regular than in the infant, the surroundings of the stall less cleanly than those of the cradle, and for other obvious reasons, the risk of erysipelatous inflammation may be greater. Retro-vaccination, therefore, of the calf, or the use of lymph taken from accidental retro-vaccination, or so-called spontaneous cow-pox, may be of use in the elimination of syphilis, but does not add to, and may detract from,

the efficacy of the lymph, which is not to be measured by the intensity of the local and general constitutional disturbance, since these may be but evidence of the presence of bacteria other than those of the vaccine proper. If, however, we are really desirous of obtaining a stock of virgin vaccine, we have but to repeat the process of transmutation of variolous into vaccinal lymph, following in the steps of our respected countryman, Ceely, with the care shown by Leonhard Voigt, and the precautions he has indicated for the performance of the operation. Three years have elapsed since his experiments were performed, and the lymph of that stock still shows some superiority over that of remoter origin, though not so marked as it did at first. It would, however, be advisable, as he himself suggests, to select the original variolous lymph from a case which, though typical, should not be malignant, and the subject of which should be otherwise healthy.

A few words in conclusion as to the time at which the lymph should be taken from the arms of children in the routine practice of vaccination. The conventional eighth day presents several advantages of a practical kind. The vesicle is then at its height, the lymph is most abundant, and the custom is convenient, as it does not require more than one weekly sitting. But we all know that in a certain proportion of cases leucocytes have made their appearance by that time, and as the recent investigations of Dr. Joseph Acker have shown, microscopical examination reveals the presence of a multiplicity of other bacilli; whereas the lymph of the seventh, sixth, and even the fifth day, while containing abundance of vaccinal micrococci, is quite free from extraneous microzooids, and gives the very best results, as I can vouch for by personal experience. Nay more, experimenters with less conscientious scruples than we in this country entertain, have found that while lymph from syphilitic infants taken on the eighth day has proved infective, that taken from the same subjects on the earlier days has been used without any unpleasant consequences. I would not justify the repetition of such experiments, but knowing that one does occasionally meet with degrees of inflammation coming within a measurable distance of erysipelas, interfering with the subsequent process of scabbing, and in no way enhancing the value of the operation, I would suggest that in private practice we should select the sixth or seventh day in preference to the eighth, leaving the public vaccinators, with their wider choice of subjects, to follow the established custom.

REMARKS ON OUTBREAKS OF CHOLERA IN SHIPS CARRYING COOLIES FROM CALCUTTA, AND IN OTHER SHIPS WITH TROOPS.

SHEWING THE PERIOD OF THESE OCCURRENCES, AND THE SHIPS' POSITIONS AT THE TIME.

By ROBERT LAWSON, LL.D.,
Inspector-General of Hospitals.

(*Read: June 10th*, 1885.)

When Mr. Corney, Colonial Surgeon, Fiji, was in this country last autumn, he mentioned that several coolie ships from Calcutta to that colony had been affected with cholera during their passage, and expressed his willingness to obtain what details he could of these occurrences on his return. Two months ago I received a communication from him on this subject, which gives information regarding four ships on their passage from Calcutta south through the south-eastern part of the Indian Ocean, a region concerning which there is little information as regards cholera available. It appears to me, therefore, that Mr. Corney's notes will prove interesting to the Society, and form a basis for further remarks on the distribution of the disease in this part of the sea. I give his memoranda in full, merely placing the third and fourth paragraphs before the second, so as to put the notes concerning the different ships in their sequence as to date of occurrence.

"Memoranda Relating to Four Outbreaks of Cholera in Coolie Ships, at Sea.

"A branch of the Indian Emigration Service is carried on with Fiji; there have been altogether nine ships despatched, with about five hundred coolies each. Of the nine, four have experienced outbreaks of cholera during the voyage, beginning in every case within a few days after leaving Calcutta, and continuing, in two of the cases, as far as the line, in the other two to the neighbourhood of the 30 deg. parallel south."

"The *Leonidas* left Calcutta on the 4th of March 1879 for Fiji, with 498 coolies, besides crew. Three days later

a case of cholera, ultimately fatal, occurred in one of the European sailors, in lat. 18° 10′ N., long. 90° 4′ E. There were others, among the coolies, on the 11th, 17th, 18th, 19th, and then afterward daily to the 25th, in lat. 3° N. No more occurred after this, and the ship may be described as free from cholera before crossing the southern tropic, or thereabouts."

"The *Poonah* left Calcutta for Fiji on April 7th, 1883. Cholera broke out on the 12th, in lat. 15° 49′ N. Fifty-four cases occurred in all, the last appearing on 12th May, lat. 11° 49′ S., temp. 87°. This was among the coolies, but a European fell ill of cholera on the 17th May, in lat. 18° 15′ S., and died on the 24th, as did the last of the coolie cases, in lat. 27° 10′ S."

"In the *Howrah*, a case occurred on board the ship before starting, died, and was buried on shore, the mother and sister being also sent out of the ship. This was on 8th April 1884, and the ship went to sea on the following day. No more occurred till the 16th, in lat. 11° 43′ N., long. 90° 38′ E., temp. 91°; and on the 22nd, in lat. 8° 12′ N., and long. 89° 29′ E., temp. 92°, three more cases appeared. No more specific cases are recorded, but much diarrhœa, with gastric irritability and fever, is mentioned almost daily as coming under the care of the surgeon, up to the time when the southern tropic was reached on the 18th May; with thermometer at 83°. The entry is then made in the diary, 'the cholera is now quite out of the ship'."

"The other ship was the *Pericles;* she left Calcutta on May 10th, 1884, with 487 coolies, and a case of cholera occurred on the 14th, in lat. 17° 23′ N., long. 90° 4′ E. The disease rapidly took a hold, and numerous cases occurred up to 7th June, many being fatal. The ship was then in 34° 46′ S., having made an unusually rapid passage through the tropics. No more occurred afterwards."

"From the details given in the medical diaries of these ships, of which the foregoing memoranda are a summary, I have prepared a chart with the view of showing at a glance the periods of each voyage respectively, during which the epidemic lasted. In every case it will be seen that the first case occurred within one week of leaving Calcutta (Garden Reach), and in that one where the source of infection was defined, a week was the interval."

"In every instance the health of the ship's company was under the immediate care and supervision of a surgeon superintendent, and prophylactic endeavours to check the

disease were no less ardently made than the efforts to save life by treatment; so that the disease had not full play."

"No cholera having been known in Fiji, it was deemed necessary to protect the Fijians by quarantining the *Leonidas* and the *Poonah* upon their arrival here. But this was as much in consequence of both these ships having had cases of small-pox during the voyage, as well as cholera. A few, perhaps ten, cases of cholera—I can only call it cholera—have from time to time cropped up in Fiji in the persons of Indian emigrants; but they have never shown any tendency to spread. So far as I can ascertain, four have been fatal. Of these ten I can vouch for four, as having come under my own observation and treatment; two of them were fatal. No case simulating cholera has ever been recorded in a Fijian, or other Polynesian,* or European, in this colony: and it appears as if the chilly and boisterous weather constantly met with to the southward of Australia is sufficiently uncongenial to the cholera germ (whatever that may be!) to so far upset its organisation as to render it innocuous as an originator of epidemic disease, though it may not entirely spoil it as a pathogenic entity."

Signed, "BOLTON G. CORNEY,
" 13, 1, '85. Acting Chief Medical Officer, Fiji."

So far Mr. Corney; the cases of cholera he met with in Fiji were in 1880. I may now add another instance of a ship, passing from India to the southward, on much the same track as those he has described, having several deaths from cholera while at sea. In a paper of Pettenkofer's, "Cholera in Ships, and the Aim of Quarantine", translated by Dr. D. D. Cunningham, which appeared in the *Indian Records of Medical Science* for July 1873, it was stated, that probably H.M.S. *Cruiser* was the only ship that had, until then, "introduced cholera into the Australian station, though no actual cases were taken thither. This occurred in 1832, when cholera broke out at Swan River in a way which is as yet unexplained." Then follows a brief detail of the cases, but without the positions of the ship when they occurred. In order to obtain further information, I was allowed, now a good many years ago, to examine the journal of the surgeon

* Except among the Northern Solomon Islanders, the New Zealanders, and New Britain people, who, not unfrequently, die through eating poisonous fungi, which gives origin to enteritis, cramps, collapse, vomiting, thirst, etc.,—a train of symptoms which, in a cholera country, might readily be attributed to that disease, as these people when sick will not speak or give any clue to their illness.—B. G. C.

of the *Cruiser* for 1831, at the office of the Director-General of the Medical Department of the Navy, from which the following particulars were obtained:—The *Cruiser* was at Bombay in May 1831, where, on 13th, a man named Tip, working on board the *Calcutta*, a new ship (though apparently living on board the *Cruiser*), was attacked with cholera, but recovered. Some time after this the *Cruiser* went to Trincomalee, in Ceylon, and subsequently to Madras, but the dates were not specified. Subsequently she sailed for Swan River, and at sea on 12th July, in lat. 4° 15′ N., long. 91° 23′ E., a man named Smallwood was attacked with cholera (the second case in the ship). On 26th July, lat. 8° 55′ S., long. 95° 22′ E., two men, Follons and Cousins, were attacked; and on 8th August, lat. 28° 25′ S., long. 84° 36′ E., a man named Johnson was attacked. These four cases all terminated in death. The *Cruiser* arrived at Swan River in August (the day not specified), and remained there during September. Cold weather and hail showers were experienced during the stay here, but there is no notice of any other case of cholera, either on board the *Cruiser* or on shore. Whether the sickness at Swan River in 1832 was cholera, as stated by Pettenkofer, or scorbutic dysentery and diarrhœa, as it has been described by others, due to the use of spoilt grain and deficiency of vegetables in a recently occupied colony, I will not attempt to decide; but as the *Cruiser* did not carry cholera into the colony, and must have left it months before the sickness just mentioned commenced, it is difficult to see how she was in any way connected with it.

In the third volume of our *Transactions*, p. 288, will be seen a paper on cholera in ships at sea, which I read before the Society in June 1871, in which the outbreaks in various ships, both in the Atlantic and Indian Oceans, are detailed as far as the facts within my reach enabled me to do. Since then the Sanitary Commissioner with the Government of India, in his report for 1881, has given, at p. 135, a "Statement of the names, etc., of vessels which have reported deaths from cholera among coolie emigrants to foreign ports, from 1871 to 1880." This includes thirty-two ships, which sailed from Calcutta for Mauritius, Natal, and the West Indies, in each of which the deaths from cholera, daily, among the coolies, are specified from the first to the twentieth day after embarkation, and above twenty days they are given in a single group. Another vessel, which sailed from Pondicherry for Martinique, in which there was one death from cholera, but the day not specified, has been omitted. I have

rearranged this table according to the days after embarkation on which the first death occurred, and from this it appears that of these thirty-two ships four had their first deaths from the first to the fourth day; in the last instance there was another death on the sixth day, and they had no more. The first death did not occur on the fifth or sixth day in any ship. In a second group, embracing nine ships, the first deaths were from the seventh to the sixteenth days; in this group the last deaths were one on the nineteenth and one on the twentieth days. In a third group of eight ships, the first deaths were all after the twentieth day, there having been no instance in which the earliest death occurred on the seventeenth, eighteenth, nineteenth, or twentieth days. There is a fourth group of eleven vessels, in three of which, with deaths up to the fifth day, others occurred from the seventh to the twentieth, but none after; two others had deaths in the whole three periods mentioned above; and six had deaths during the second and third periods only. The details are given in the Table annexed. The total number of emigrants from Calcutta in the ten years was 129,527; of these, 14,752, or 11.4 per cent., sailed in the above-named thirty-two vessels, and of these 181 died of cholera, or 12.3 per 1,000 of those embarked in them.

Dr. Bryden, in his *Report on the General Aspects of Epidemic Cholera in* 1869, published in 1870, as a sequel to his *Report of the Cholera of* 1866-68, gives, at page 54, a statement showing the deaths from cholera, day by day, in emigrant ships from Calcutta to Mauritius, for the eleven years 1850-60, and to the West Indies from 1861-69. The number embarked for Mauritius was 105,382, of whom 22,077, or 21 per cent. of the whole, sailed in ships that suffered from cholera; among these there seem to have been 288 deaths from that disease, or 13.0 per 1,000. The number who proceeded to the West Indies was 72,681; of them, 8,284, or 11.4 per cent., went in ships in which cholera appeared, and eighty-nine seem to have died of it, or 10.7 per 1,000 of those embarked. Hence the percentage of ships attacked with cholera from 1850 to 1860 was about twice as great as from 1861 to 1869, or 1871 to 1880, but the ratio per 1,000 of deaths from cholera in them, in the three periods, were 13.0, 10.7, and 12.3 respectively, showing that the incidence of the disease in these ships was very much the same in all the three periods.

The sailing instructions for ships proceeding from Calcutta to the southward of the equator, recommend they should go south along the meridian, 90° E., so as to cross the line

from that to 93° or 94° E. After passing through the variable winds, met with between the line and 4° or 12° S., according to the season, they reach the south-east trade. For ships bound westward this is a fair wind, but those going east have to get through the trade to avail themselves of the westerly winds that prevail to the south of it. The track chart Mr. Corney transmitted with his paper is on too small a scale to enable the ship's position from day to day being made out distinctly, but it shows clearly enough that those he mentions followed the general direction here indicated, and others, of which the positions were given in my paper already alluded to, bear out the same view.

After embarking their emigrants, the ships, since 1871 at least, seem to have been towed out of the river, so as to be in the open sea on the second day; in estimating their positions, subsequently, no material error will be committed if the seventh, sixteenth, and twenty-first days after embarkation be reckoned as the sixth, fifteenth, and twentieth days after leaving the land. Employing the observations in Mr. Corney's notes (omitting the *Pericles*), as well as those in my former paper, the approximate latitude of sailing ships from Calcutta, on the sixth day at sea, is about 15° N., on the fifteenth day about 7° N., and on the twentieth day about 1° N., with a variation in individual cases of about three degrees either way at the last. It thus appears that, in sailing vessels, the first of the three outbreaks noticed above must have occurred near the 90° meridian, and to the north of about 16° N., the second commenced from 15° N. to 7° N., and the third about 1° N. onwards; and the factors which determine them must have become active about their positions respectively. The deaths in the first group being within the usual periods of embarkation, may be due to exposure on shore; but those in the second, and still more in the third, group cannot be explained in this way. It is also worthy of notice that, from September 1871 to November 1874, twenty-five of those ships were affected; from 1875 to 1878, inclusive, seven only were attacked, and in 1879 and 1880 there was no cholera among emigrant coolies to the westward at all. Further, of the sixteen ships in which cases occurred on the twentieth day, there were two in 1871, two in 1872, six in 1873, four in 1874, one in 1875, and one in 1878. The incidence of cholera in Hindostan was very slight from 1871 to 1874, and, indeed, during the latter half of the period it may be said to have almost disappeared, except in the endemic area, and districts to the north-westward; but in 1875 the peninsula was almost

covered, from Cape Comorin to Lahore, with a severe epidemic. To the east of the Bay of Bengal, however, cholera was in force several of those years; there seems to have been an outbreak in the Island of Timor in 1872, and in 1873 it was epidemic at Singapore, in the Kingdom of Siam, and along the valley of the Irawaddy from Rangoon to Bhamo, and the Dutch troops at Acheen, at the north end of Sumatra, were attacked in December. How far these manifestations of the disease after the twentieth day in ships, during 1873-74, may have been connected with its peculiar distribution on shore may be questionable, but the coincidence deserves notice.

From the day of embarkation to that of disembarkation at their destination, the average period the emigrants were on board, in six ships that went to Mauritius, was 40 days, the extremes being 37 and 47. In those that went to Natal the average was 60 days, the extremes being 53 and 65; but a steamer, the *Blenheim*, had them on board 26 days only. In thirteen ships that sailed for Demerara, the average period on board was 90 days, the extremes being 80 and 118; but a steamer, the *Enmore*, had them 53 days only. The sailing ships all come into the positions of the respective groups as given above, but the steamers deviate from this very much; the *Blenheim*, which had five deaths from cholera after the twentieth day, must then have been to the south of Mauritius, as she landed her emigrants at Natal on the sixth day thereafter. The steamer *Enmore*, which had two deaths by the fifth day, had three from the eleventh to the twentieth, and five after the twentieth, by which time, like the *Blenheim*, she must have been south of Mauritius. From these facts it is obvious that the factors which the sailing ships came under about the equator in 90° E., after the twentieth day, are not confined to that locality, but were met with by the *Enmore* south of Mauritius in July 1873, and by the *Blenheim* in the same locality in July 1874.

The cases of the *Gertrude* and *Queen of the North*, given in my former paper, afford an additional illustration of where these factors are to be met with. The *Gertrude* left Calcutta in May 1859, with 120 military invalids, and some other passengers, and her crew; on the seventeenth day after leaving land, in 2° N., 89° E., the first case of cholera occurred, but recovered; on twentieth day another case occurred, and the man died next day; on twenty-first day, in 4° S., 92° E., three cases occurred, all fatal; on twenty-fifth day, when about 11° S., 81° E., another case, that proved fatal next day, and a number of doubtful ones appeared;

on thirty-first day, in 22° S., 66° E., a seaman was attacked, who died next day; and finally, on thirty-fourth day, about 24° S., 58° E., a soldier was attacked, and died; the last two instances in the neighbourhood of Mauritius. The *Queen of the North* left Bombay with a crew of 27, and 272 troops, women, and children, in January 1864; on the eleventh day at sea, in 3° N., 77° E., the first unequivocal case of cholera appeared, and proved fatal; the following day there was another case; on fifteenth day, in 2° S., 79° E., two cases occurred; and on the eighteenth day an outbreak commenced, during which, up to the twenty-fifth day inclusive, there were 37 attacks, of which 24 were fatal; on the eighteenth day the ship's position was 6° S., 81° E., and on twenty-third day, 10° S., 81° E., very close to that of the *Gertrude* on her twenty-fifth day out; and, having caught the S.E. trade that day, the course of both ships was parallel subsequently, though the *Queen of the North* did not suffer again, as the *Gertrude* did, when passing Mauritius.

When present, the choleraic influence is generally diffused very extensively in the south-western part of the Indian Ocean, though cholera may not become epidemic at many points; and, what is worthy of remark, it often shows itself in the form of sporadic cases, sometimes fatal, and accompanied by an unusual prevalence of choleraic diarrhœa, in the Cape Colony or Natal, some months before the disease becomes epidemic elsewhere. Thus, in the first six months of 1835, there was a very unusual frequency of sporadic cholera in the Cape Colony, with several fatal cases, and in the end of that year an epidemic commenced at Zanzibar. In 1859 there were indications of cholera at the Cape, and in October a few cases at Mauritius, and early in 1860 at Bourbon, and in December 1859, there was an outbreak at Zanzibar. The *Gertrude*, just mentioned, had two cases south of Mauritius in the end of June. In 1861 there was, in February, an outbreak of choleraic diarrhœa at Maritzburg, in Natal, and at last one case which went into collapse with all the characteristics of malignant cholera. Cholera became epidemic in Mauritius in December that year, and in Johanna, one of the Comoro Islands, in February 1862. The *Alnwick Castle*, carrying coolies, had a case on 27th November 1861, in 23° S., 57° E., south of Mauritius; the ship was then thirty days at sea, and there had been no other case since she sailed. The *Echunga*, with naval and military invalids from Hong Kong, arrived at Mauritius on February 1st, 1862, and sailed for England on the 13th; the cholera was then epidemic, and three deaths from it took place among

the invalids up to the time of sailing; on the 14th, the first day at sea from Mauritius, there were two deaths from cholera; on the third day, three; on fourth day, one; on fifth day, three; on seventh day, two; and on eleventh day, three. If, as in the case of ships leaving Calcutta, the deaths up to the fifth day be set down to the influences the passengers were exposed to before leaving the land, those on the seventh, and still more on the eleventh, day will be attributed to factors operating at sea, as in the *Alnwick Castle*, and other ships referred to in this paper. I have not been able to obtain the position of the *Echunga* on the eleventh day after leaving Mauritius; the *Alumbagh* (mentioned below) made the passage from Mauritius to Port Elizabeth, in February and March 1866, in fifteen days, having had a fair wind the whole way; at a similar rate, the *Echunga*, on the eleventh day, should have been about 33° S., 36° E., not far from the point where a man of the *Windsor Castle* (also mentioned below) was attacked four years later. Her Majesty's ship *Orestes* left Mauritius on 30th January 1862, and after touching at Tamatave, in Madagascar, arrived at Pomoney, in Johanna, on 8th February. Next day one of her marines was attacked by cholera, but recovered; another, who had nursed this man, was attacked on February 15th, and died next day; how long the ship remained at Pomoney is not mentioned. After leaving that place, the *Penguin*, which was in search of her, arrived from Mauritius, having had no case of cholera on board; while at Pomoney, two kroomen from the shore employed coaling were attacked on board, and were sent on shore, where they died; the disease spread through the island subsequently. In 1865 there were again sporadic cases of cholera and choleraic diarrhœa at Cape Town in February; a case of sporadic cholera at Port Elizabeth on 30th October; and another in a soldier who had embarked in the *Renown* at the same place on 9th November, and was attacked at sea on the 12th, just off the coast, in 29° E. The *Renown* had had an outbreak of cholera on her passage from Gibraltar to the Cape, in September, the last case having occurred on the 19th of that month. In September there were some cases of cholera in emigrant ships in quarantine at Mauritius, and several on shore, and the disease had been prevailing in the Somali ports, to the north of Zanzibar, from April to June. In 1866 the *Alumbagh*, from Mauritius to Port Elizabeth with troops, had a case of cholera about 1st March, midway between these places. The *Durham*, which sailed with troops from Calcutta, in February 1866, had seven attacks of cholera (five of them fatal), the last on April 1st, in 20° S. and 72° E.,

about due east of Mauritius, on the thirty-fifth day after leaving land. In April, the *Newcastle*, from India, which called at Cape Town, had a case midway between that and St. Helena. The *Windsor Castle*, which had been affected with cholera on her passage from England, the last attack in a soldier's wife having occurred on 20 August, and which terminated fatally on September 3rd, in 34° S., 8° E., from secondary fever, had a seaman attacked on September 15th, in lat. 37° S., long. 39° E., who died in a few hours. And in October, a lady, who had not been out of the colony, died in Cape Town of cholera. In December, choleraic diarrhœa was again frequent at Maritzburg, in Natal, and in February 1867, at Cape Town and Port Elizabeth. In 1869 there was a case of cholera, designated simple, among the troops at Cape, in May; and in December there was a fatal case among the troops at Mauritius, and several among the civil population; and an epidemic commenced in Zanzibar in October, which continued severe in 1870, and extended to the Mozambique coast, and in 1871 embraced the east coast of Madagascar, the Comoro Islands, and the African coast as far as the mouths of the Zambesi, in 19° S.

Cholera had been met with extensively in the southern hemisphere about the time just mentioned. It had appeared at Rio Janeiro early in 1867, and later in the year cases occurred at Buenos Ayres, leading up to a severe epidemic in 1868; this place is in 34° S., the same lattitude as the Cape of Good Hope. In Tasmania, in 43° S., there were two deaths from cholera in 1868, and in 1870 there were five; unfortunately I have not been able to obtain notices for other years for Tasmania, or the neighbouring Australian colonies. In New Zealand, when our troops were there some years previously, there were cases every summer, from that of 1862 to that of 1866, inclusive; in the first three years there were two in each; in 1865 there were eight attacks and two deaths; and in 1866 three attacks but no death. From 1867 to 1869 there was no cholera. These cases occurred at Auckland, or its neighbourhood, in 37° S.; and though the men who died had served in India, they had been in New Zealand more than a year before they were attacked. Auckland is 20° almost due south of Fiji.

The facts detailed above, collected from time to time during many years, show the importance of recording even the slightest appearances of cholera, with the localities and dates; for such manifestations are not fortuitous, but bear a definite relation to the distribution of those factors which, when fully developed at any point, give rise to an epidemic. The

frequent occurrence of choleraic manifestations at the Cape and Natal, accompanied by, or followed in the course of a few months by sporadic cases of malignant cholera or epidemics at Mauritius, or along the east coast of Africa, and in the adjacent islands, shows clearly they were all subjected to the same influence about the same time; and the appearance of single cases in ships at sea, between these extreme points, at such times, though they may have had no communication with the land, indicates that this influence is active over the sea as well as the land, and leads to the appearance of cholera when the requisite personal and local conditions are present. On the other hand, the appearance of choleriform disease, at any point, affords a fair presumption that the influence in question is in operation there at the time, and the space it covers can be marked out by numerous observations of similar disease in different localities about the same time; and thus the experience of ships at sea within the limits mentioned, or even at some distance outside them, affords important information, as may be seen from the details already given.

From the evidence stated above, it is clear that cholera is much more common to the south of the equator, in the Indian Ocean, than is generally supposed; and undoubted cases of this disease have been met with, on the African side, in the *Windsor Castle*, in 37° S., and on the Australian side in the *Cruiser*, in 28° S., and in the *Pericles* even in 35° S., while deaths have occurred from it near Auckland, in New Zealand, in 37° S., and in Tasmania, in 43° S. Though as yet there is no record of an epidemic south of the tropic, these facts indicate that even Tasmania is within the range of the factors necessary for its development, and may hereafter experience one. The appearance of cholera in Fiji, mentioned by Mr. Corney, is interesting, and when the recurrence of the disease there, and, if possible, in the space between that and the countries to the westward, where its history is better known, they will be of much value for elucidating the distribution and progress of cholera in that part of the world.

As regards duration of outbreak: in the first two groups there were five instances in which there was but a single death; and in four others they did not extend beyond four days; in two others the deaths from first to last embraced seven days; in one eight days; and in one, with four deaths in six days, there was another on the seventh day after. In the third group, above twenty days, there were two single deaths; the other six cases do not have the days specified. In the

fourth group there are two instances of first deaths on fourth day, and the last on the third and fourth thereafter; and of those with first deaths from seventh to sixteenth days after embarkation, there were two in which these occurred on one day only, two others in six or under, one in nine and another in two days; in all these there were further deaths after twenty days. From these facts it is obvious that a normal outbreak of cholera in a ship at sea does not extend beyond the seventh or eighth day, though occasionally, from the last deaths not occurring until the third day after attack, or longer, single deaths may be recorded on ninth day or later. In the majority of ships there is but a single outbreak; in others, cases have appeared in two, or even all the three different periods mentioned above; but the whole body of evidence is directly at variance with the theory that the disease was originally introduced from the shore, and continued by a succession of cases until the chief outburst occurred.

There is very little notice of the immediate exciting cause of the disease in various ships. In the *Queen of the North* the water became opaline when exposed to the air for some time, but this was the case before the severe outbreak from eighteenth to twenty-fifth day, and continued after it ceased. In other ships, as the *Renown* and *Windsor Castle*, distilled water only was used from the appearance of cholera, but it went on nevertheless. The close, warm weather met with near the equator has been frequently mentioned as favouring an outbreak, and there seems to be some ground for this opinion; the severe outbreak in the *Queen of the North* commenced in such weather, and the attacks ceased on third day after reaching the S.E. trade; in the *Durham* this was much complained of, and, to relieve the berth deck as much as possible, nearly half the troops were allowed to sleep on the upper deck in the open air, and it was remarked that none of them were attacked. On the other hand, the *Oriental* steamship, which carried troops from Bombay to Mauritius in 1859 during the S.W. monsoon, was considered to be overcrowded, and a portion of the troops slept on deck exposed to the weather: there were ten deaths from cholera among these, while those who were accommodated below escaped.

The above details place it beyond doubt that ships, traversing the Indian Ocean, pass through localities in which their passengers suffer from cholera many days after they have left the land and its immediate influences; and, as in most instances, there has been no succession of cases to keep up the disease from the date of sailing, its occurrence must be

TABLE *shewing the Deaths from Cholera among the Coolies in each of the undermentioned Ships on the passage from Calcutta to Mauritius, Natal, or the West Indian Colonies, from* 1871 *to* 1880 *inclusive, with the Days after Embarkation on which they occurred.*

SHIPS' NAMES.	Coolies Embarked.	Date of Embarkation.	DEATHS FROM CHOLERA EACH DAY AFTER EMBARKATION.																				Total Deaths from Cholera.	Date of Disembarkation.	Place of Disembarkation.
			1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	above 20.			
Rohilla	425	17 Feb. 1874	2	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	11 May 1874	Demerara.
Atalanta	393	22 Mar. 1876	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	13 May 1876	Natal.
Glenroy	486	18 May 1878	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	17 July 1878	Natal.
Fateh Salam ...	275	7 Mar. 1872	..	..	..	4	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	13 April 1872	Mauritius.
Allumghier ...	340	28 May 1873	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	30 June 1873	Mauritius.
Woodburn ...	577	1 Aug. 1874	..	..	..	..	..	..	..	1	1	1	..	..	1	..	..	..	..	..	..	1	..	5	3 Nov. 1872	Trinidad.
Kate Killock ...	456	5 Aug. 1872	..	..	..	..	..	..	..	2	1	4	5	1	..	..	1	..	..	..	..	..	..	14	12 Nov. 1872	Demerara.
Merchantman ...	383	25 July 1873	..	..	..	..	..	..	..	..	2	1	1	..	..	..	..	..	..	..	..	..	..	4	1 Sept. 1873	Mauritius.
Loch Lomond ...	518	27 Jan. 1874	..	..	..	..	..	..	..	..	..	..	1	3	3	..	1	2	1	..	..	..	...	11	21 April 1874	Jamaica.
Ophir	351	19 June 1878	..	..	..	..	..	..	..	..	..	..	..	..	1	2	..	..	..	..	1	..	..	4	22 Aug. 1878	Natal.
Lincelles	342	7 Oct. 1874	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	1	3	..	..	..	..	7	8 Jan. 1875	St. Vincent.
Wellesley	334	14 May 1872	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	29 June 1872	Mauritius.
Linguist	600	2 Aug. 1876	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	20 Oct. 1876	Demerara.
Humber	462	31 Mar. 1872	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	9 Sept. 1872	Jamaica.
Shah Jehan ...	285	30 Mar. 1873	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	8 May 1873	Mauritius.
Golden Fleece ...	524	2 Sept. 1873	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	30 Nov. 1873	Demerara.
Hereford	568	20 Sept. 1873	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	9 Dec. 1873	Demerara.
Blenheim. *steamer*	692	13 June 1874	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	8 July 1874	Natal.
Golden Fleece ...	519	6 Aug. 1874	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	29 Oct. 1874	Trinidad.
British Empire ...	643	8 Nov. 1874	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	25 Feb. 1875	Trinidad.
Lady Melville ...	391	12 June 1875	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	24 July 1875	Mauritius.
Neva	484	23 Nov. 1872	..	..		1	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	25 Feb. 1873	Demerara.
Sea Queen	328	4 Sept. 1872	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2 Dec. 1872	Jamaica.
Artist	552	30 Sept. 1877	..	1	..	..	1	..	1	..	2	..	1	..	..	..	..	1	..	..	..	1	..	8	29 Dec. 1877	Demerara.
Enmore, *steamer* .	577	4 July 1873	..	..	1	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	1	1	5	10	25 Aug. 1873	Demerara.
Sir Henry Lawrence	462	16 Sept. 1873	1	..	..	..	..	..	..	1	..	..	1	2	..	..	..	..	..	..	1	..	..	6	12	15 Dec. 1873	Demerara.
Adamant	343	22 Sept. 1871	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	23 Dec. 1871	Demerara.
Poonah	506	22 Feb. 1872	..	..	..	..	..	..	..	..	..	1	..	..	1	3	1	2	2	3	..	..	..	5	18	18 June 1872	Demerara.
Boyne	568	13 Feb. 1878	..	..	..	..	..	..	..	..	..	1	..	1	2	2	..	..	..	..	1	..	..	6	13	15 May 1878	Demerara.
Medea	431	8 Nov. 1871	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	..	9	11	26 Jan. 1872	Demerara.
Forfarshire ...	509	18 Aug. 1874	..	..	..	..	..	..	..	..	..	..	..	..	..	6	1	2	2	..	2	..	1	14	5 Nov. 1874	Demerara.
Syria	438	24 Aug. 1873	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	2	6	27 Nov. 1873	Trinidad.

attributed to factors that they encountered in the localities where they suffered. These factors occupy fresh localities from time to time, as they do on land; and when that from Mauritius to the east coast of Africa is involved, as shown by the existence of cholera on shore, ships passing in the vicinity of these points have had one or more cases, though they had been many days at sea, and without any recent, or even any previous case, the essential factors then must be altogether independent of the shore, or of previous cases, and in fact can only be those designated epidemic or pandemic causes.

VENTILATION WITH AIR FROM SUPERIOR LAYERS IN PLACE OF INFERIOR LAYERS.

By EDWIN CHADWICK, C B.

(*Read: June 10th*, 1885.)

In sanitary inquiries my attention was early directed to instances of layers or *strata* of air of malarious influence, such as this: A medical officer, pointing to a mist, spread like a sheet over a valley, said, "That sheet just covers the bulk of my patients; out of it or above it I have nothing scarcely but midwifery cases and accidents. I have had instances of children whose heads were above a visible mist escaping attack, whilst the smaller children covered by the mist suffered from them; of examples of the occupiers of the cellars, and the lower stages in towns, suffering from cholera and other epidemic visitations, whilst those living in the upper flats or highest stories entirely escaped from them, except in the attics, for which there was special reason; cases of experiences in India, where men could not travel in safety at night across valleys, whilst men on elephants, being above the malarious layer, could do so; of people raising their habitations on stilts, as is universally done in Burmah, to escape the mephitic influences of which they have had experience."

Mr. Glaisher, the aeronaut, writes to me:—"When in the car of a balloon I have been struck with the definite boundary of mists at times when there has been but little generally, and I found afterwards that the mists were located over marshes or clay soil, when gravelly soil was free. The ventilation of the Underground Railway could be effectually carried out by your suggestion."

The general effect of land drainage has been to reduce mists, and in some instances to remove them entirely. In such instances it has reduced or removed the plague of midges in England. In one instance in Algeria of which I was informed, the drainage of a district, and its close cultivation, entirely removed the plague of mosquitoes which had rendered it almost uninhabitable. In the Fen districts of Lincolnshire the land drainage has reduced mists, and so

reduced ague that ounces of bark are not now used where pounds were used formerly. It is for entomologists to show on what these animalcules subsist where there are no human or animal subjects to prey upon, and what is the superficial extent of their feeding ground. On the occasion of choleraic visitations extraordinary developments of insect life were in some instances observed, generally in low-lying layers, but they passed without any examination of which I am aware. I point out these incidents for the observation of naturalists, and the favour of information from them.

From Highgate Hill I have observed mists spread over the metropolis like a blanket, and the upper dome, of St. Paul's Cathedral appearing clear and bright above it like a spike through the blanket. I have ascended that dome, and found there a clear, freshening breeze, as good in sensation as any on the Surrey hills; whilst the air beneath, in the adjacent streets, was comparatively stagnant and unrefreshing.

Dr. Gordon Hardy writes: "Riding on the 'Maidan', in Calcutta, I have often had sight only of riders' heads above a level of dense fog."

On a discussion of the subject with the late Dr. Neil Arnott, a pre-eminently good sanitarian and an able mechanician, it appeared that we might form a Pure Air Company, which would engage to draw the air from a suitable height above the common layers, and distribute it into houses by engine power, or as gas is distributed, and do it with a profit, at a very low rate; or for some few shillings a year give even a better air than people generally obtain in suburban residences. The principle may now be presented for consideration for hospital construction, and the excessive mortality that is prevalent in the larger hospitals, beyond that which prevails in the smaller ones, and in reduction of the necessity of washing the air in the town hospitals for the performance of operations.

I have visited hospitals in Paris where the methods of *internal* ventilation are, in my view, excellent and superior, but where all draw in the air from the lower layers of the outside street air. I do not know of one instance where the expedient of drawing in a superior air from a height has been adopted or thought of. In England I have known of hospitals very well ventilated—internally, mechanically—which have drawn their external air from lower couches that were positively very bad, and the more the wards were ventilated the worse they often were. Indeed, it is sometimes proposed as a principle, as against that of extraction, that ventilation is best effected by "currents of fresh air brought in by open

windows placed in opposite sides of the wards". But this "fresh air" is the common street air, really foul air polluted by street emanations from sewers and cesspools, requiring washings before operations can be safely performed. It is well known that surgical operations cannot be performed with safety in town air (unless it is washed) that may be performed with increased chances of favourable results in a good suburban air.

In Paris two systems of ventilation were in competition when I visited the hospitals: one of "propulsion", or driving in the air; the other of "aspiration", or of drawing it out by suction. It appeared that the practice of propulsion drove the air in heaps, leaving corners stagnant; whilst the method of aspiration, or suction, operated perfectly in removing the air nearest to them from the points of vitiation in the time required, and in introducing really fresh air from the points farthest from vitiation and at the temperature required; and also in maintaining passages and cabinets at a temperature equal to that of the interior rooms. Notwithstanding the fault of ventilating with the generally cesspool-tainted and impure street air, the effect of the system of "aspiration" appeared to be in advance of at least one-fourth of the common methods of hospital ventilation.

This principle of aspiration appears to me to be peculiarly adapted to drawing in the air from the superior layer, obtained from two, three, four, or five hundred feet, or whatever height it may be desired.

The principle is peculiarly applicable to India and to Southern cities generally, for the securing of refreshing sleep free from the plague of mosquitoes.

A friend, a great traveller, found out that mosquitoes lived and fed exclusively in the animalised gases diffused amongst the lower layers of air. He suffered intensely from the bite of these insects, and to escape them when he came near the coast, he made his bed aloft on the crosstrees of the mainmast; and when he went on shore he astonished the natives by seeking for some steeple where he could make his bed.

The principle proposed would bring in air free from the insects, and carry those in the building away from it. The engine-power required for the service would be less than that for ventilation by the punkahs.

The system of extraction, as managed by Léon Duvoir le Blanc, allowed the most complete adaptation to requirements. At its outset he asked the medical authorities of the hospital to be ventilated, that of La Riboisière: At what temperature do you require the air to be kept?—At 60 deg. How often

do you require it be changed?—Once every hour, night as well as day. In what direction do you require it to be removed?—Downwards, between each bed. All this was done completely by a hot water tank on the roof. Having been pressed by other questions, I have not been in a position to obtain by observation and experiments the precise results which I would now seek. I obtained a promise from my late lamented friend, Dr. Angus Smith, who had been the foremost in analysing air, that he would make the experiments I suggested: of sending up a balloon with a self-registering thermometer to ascertain the temperature at different heights; and also a bottle filled with water, with a self-closing tap, capable of being opened from below, so as to bring down specimens of the air to be tested. Hence, for the East or anywhere, it may stated that we are not dependent on the superior layers of air for the temperature. It may be given to it below in various ways. I was assured that at La Riboisière the contract to keep the temperature night and day at sixty was duly performed. When it was below that temperature it was warmed by being led over warmed surfaces on admission, and when it was above that temperature it was cooled by being passed over surfaces cooled down by evaporation. I was assured that the practicability of doing this may be considered as settled. All this was done at a less expense than that of warming edifices by the ordinary method; and all this, it is suggested, can be done for sleeping-rooms in India, and for offices; but the most convenient power for working the system of "aspiration" would, I expect, be by hot-air engines, which may be had of one, two, or three-horse power, and go on working for a long time, with little care. Small steam-engines would be available for larger buildings. If the principle be approved, plans for its application, according to conditions, may be got out.

In the construction of towers for the obtaining of pure air, it appeared to me undesirable that the common absorbent brick should be used. Constructions of non-absorbent concrete appeared to me to be the most eligible; and constructions with large hexagonal pots would have considerable advantages. The requisite heights would have to be ascertained experimentally. The impure layers of air might often be avoided by inconsiderable elevations. Experimentation and observations on the points suggested would be of the greatest importance in the tropical districts where rest and refreshing sleep are difficult to be got, and where even existence is a torment.

In some experiments made on the Continent for ascertain-

ing the presence of ozone, the ozone was obtained at the top of a cathedral, whilst none was to be got at the base. In the case of a high building, or, indeed, from the level ground, experiments for testing the temperature and quality of the air might easily be made by sending up with a strong kite a self-registering thermometer, and also by sending up a balloon carrying a bottle filled with water, fitted with a self-closing top or stopper, which, being pulled by a string, would let the water escape, and so samples of air might be brought down for analysis.

JOHN NETTEN RADCLIFFE.

(*President*, 1875-77).

It is with much regret that we have to record the death of one who for over thirty years had been an active supporter of the Epidemiological Society. Elected as an ordinary member in 1850, John Netten Radcliffe admirably performed the duties of Honorary Secretary from 1862 to 1871, and in 1875 he was unanimously elected to the Presidency. The services which Netten Radcliffe rendered to the Turkish Government, especially in the matter of hospitals, at the time of the Crimean War, appear to have constituted a turning point in his professional career; for ever after that date he made cholera, and other diseases of the Levant, a special study. Hence he was selected by the Privy Council to prepare a series of reports on cholera, both during and subsequent to the epidemic of 1865-66; and both these and his further papers, compiled after the outbreak of 1871-73, constitute to this day the standard British records of those European epidemics. Between the two periods referred to, Radcliffe's entire services were secured by the Privy Council Office, and many of the reports which he presented to that office, and later on to the Local Government Board, give proof of the immense labour which he bestowed upon his work, and of the high standard which he so successfully sought to attain in all his contributions to the study of epidemiology and public health. Amongst these reports some of the most valuable are the following: "On the Sources and Development of the Diffusion of Cholera in Europe", 1865; "On an Outbreak of Cholera at Theydon Bois", 1865; "On the East London Cholera Epidemic", 1866; "On the Means for Preventing Excrement Nuisances in Towns and Villages", 1869 and 1873; "On an Outbreak of Enteric Fever in Marylebone", 1873; "On the Diffusion of Cholera in Europe during the Ten Years 1865-74"; "On the Progress of Levantine Plague, 1875-77"; and "On Erysipelas in the Radcliffe Infirmary, Oxford, the Norfolk and Norwich Hospital, and the Manchester Royal Infirmary". The *Transactions* of the Society also contain on many of their pages indelible proof of the literary and scientific merits of his labours.

Of his personal characteristics, Radcliffe's late chief, Mr.

John Simon, C.B., F.R.S., in a tribute to his memory, wrote the following words:* "Thoroughly kind-hearted (indeed soft-hearted) towards his fellow-creatures, always generous of help and sympathy, very susceptible of personal attachment, and very staunch in retaining it, he always seemed to me to be equally characterised by the straightforward truthfulness and loyalty of a remarkably simple and honest nature".

* *Lancet*, Sept. 27th, 1884, p. 562.

The Ordinary Meetings of the Society are held at

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THE CHAIR IS TAKEN AT EIGHT O'CLOCK P.M. PRECISELY.

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Non-Resident Members are not liable to further payment. They have the privilege of attending meetings, and are entitled to receive the publications of the Society issued during the year for which their subscription is paid; but they are not entitled to vote at meetings of the Society nor to hold office in it.

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